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THE USE OF SCHOOLS.

BY

THOMAS CARPENTER,

AUTHOR OF "THE SCHOLAR'S SPELLING ASSISTANT," &c.

NEW EDITION.

CAREFULLY CORRECTED AND CONSIDERABLY ENLARGED,

BY

W. RUTHERFORD, LL.D., F.R.A.S.,

ROYAL MILITARY ACADEMY, WOOLWICH.

LONDON :

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## PREFACE.

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THE following pages, it is hoped, will not be deemed unworthy of the attention of those whose avocation it is, amongst other professional engagements, to guide the young scholar through the elementary branches of arithmetical knowledge. In the present volume will be found a greater variety in the art of computation than is given in the generality of books on the same subject; and everything that appeared superfluous or irrelevant has been omitted.

There are, doubtless, many books published on the science of Arithmetic, and not a few deserving of encouragement; but still the art is not so far worn out



as to supersede the attempt of rendering it more practical and advantageous. WALKINGAME's Treatise has had a considerable share of patronage, although, perhaps, it may be regarded as somewhat too theoretical. Like many others, however, it has its merits, and contains much useful and valuable information.

The Author has selected some questions with their answers from other publications, and incorporated them with his own; in doing so, he trusts he need not apologize to his brethren in the profession; but for which he feels himself under peculiar obligations. From the reception the Author's former works have met with, he is encouraged to hope that his present attempt will not be without benefit to the rising generation.

\*.\* The Editor of this edition of CARPENTER'S ARITHMETIC has re-worked every example, and inserted several rules which had been omitted in the former edition. The Double Rule of Three, or Compound Proportion, is a very useful part of Arithmetic; and its entire absence from the former edition was a serious defect. The

methods of finding the Greatest Common Measure, and the Least Common Multiple, of two or more numbers, have also been supplied, as well as the new and simple method of extracting the Cube Root of any number. These and other improvements will, it is hoped, render the work very useful to the young arithmetician.

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## MARKS AND SIGNS.

<i>A</i> , at.	<i>B.A.</i> , Bachelor of Arts.
<i>C.</i> or <i>Cwt.</i> , one hundred weight, or 112 lbs.	<i>F.R.S.</i> , Fellow of the Royal Society.
<i>Cr.</i> , creditor.	<i>Q. D. quasi dicas.</i> , as if he should say.
<i>B. P.</i> , bills of parcels.	<i>L. liber</i> , a book.
<i>Ditto</i> or <i>Do.</i> , the same.	<i>Co.</i> , company.
<i>Dr.</i> , debtor or doctor.	<i>I. E. id. est</i> , that is.
<i>Fol.</i> , folio.	<i>Inst.</i> , this month.
<i>No.</i> , number.	<i>Ult. ultimo</i> , last month.
<i>Qt.</i> , quantity or quart.	<i>MS.</i> , manuscript.
<i>Per</i> or <i>pr.</i> , by.	<i>MSS.</i> , manuscripts.
<i>P. S.</i> , postscript.	<i>Q.</i> , question.
<i>L. libra</i> , a pound sterling.	<i>A.</i> , answer.
<i>S. solidus</i> , a shilling.	<i>E. G. exempli gratia</i> , as for example.
<i>D. denarius</i> , a penny.	<i>Rev.</i> , reverend.
<i>Viz. videlicet</i> , that is to say.	<i>M. P.</i> , Member of Parliament.
<i>O. S.</i> ; old style.	<i>E. W. N. S.</i> , east, west, north, south.
<i>N. S.</i> , new style.	<i>N. L.</i> , north latitude.
<i>A. M.</i> , <i>ante meridiem</i> , in the forenoon.	<i>S. L.</i> , south latitude.
<i>P. M.</i> , <i>post meridiem</i> , in the afternoon.	<i>Et Cætera</i> , and so forth.
<i>L. D.</i> , Lady-day.	<i>Per cent.</i> , by the hundred.
<i>Mds.</i> , Midsummer.	<i>In toto</i> , altogether.
<i>Michs.</i> , Michaelmas.	<i>Item</i> , also.
<i>Xmas.</i> , Christmas.	<i>Mem. memorandum</i> , things to be remembered.
<i>Qr.</i> , quarter.	<i>Vide</i> , see.
<i>St.</i> , saint.	4° 15' 33"—4 degrees, 15 minutes, 30 seconds.
<i>D.C.L.</i> , Doctor of Civil Law.	<i>Vid.</i> , by the way of.
<i>LL.D.</i> , Doctor of Laws.	<i>Vice</i> , in the room of.
<i>D.D.</i> , Doctor of Divinity.	
<i>M.D.</i> , Doctor of Medicine.	
<i>M.A.</i> , Master of Arts.	

# ARITHMETIC.

---

ARITHMETIC is the science which treats of *numbers*. The number *one* is called *unity*; and an *integer* or *whole number* is a collection of *units*.

The figures 1, 2, 3, 4, 5, 6, 7, 8, 9, express the numbers *one, two, three, four, five, six, seven, eight, nine*, respectively; and the figure 0 expresses *nought* or *nothing*. By means of these *nine digits*, and *nought* or *zero*, any number whatever may be expressed; but to effect this each figure is supposed to have *two values*, a *proper* or *simple value*, and a *local value*. Thus in the number 10, the figure 1 is considered to express *ten* units; in the number 21, the figure 2 expresses *twice ten* or *twenty* units; and in the number 300, the figure 3 expresses *three hundred* units.

The four fundamental Rules of Arithmetic are *Addition, Subtraction, Multiplication, and Division*.

The following *signs* are used in Arithmetic :—

+ *Plus*, or *more*, the sign of Addition; as,  $4 + 2$ .  
 — *Minus*, or *less*, the sign of Subtraction; as,  $6 - 3$ .  
 × *Multiplied by*, the sign of Multiplication; as  $4 \times 2$ .  
 ÷ *Divided by*, the sign of Division; as,  $8 \div 2$ .  
 = *Equal to*, the sign of Equality; as,  $4 + 2 = 6$ .  
 :: : are the signs of Proportion; as,  $1 : 2 :: 3 : 6$ ,  
 and read thus: one *is to* two, *so is* three *to* six.

√ is the sign of the *Square Root*, and √ that of the *Cube Root*.

## ROMAN NUMERALS.

I. 1	X. 10	C. 100	XIX. 19	LXXXVIII. 88
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## SIMPLE ADDITION.

SIMPLE ADDITION teaches to find the full or total amount of sums or quantities of the same name.

£	s.	Yards.	Bushels.	Gallons.
1	14	241	6249	141268
—	—	216	116	271164
2	26	171	164	71681
3	40	276	16	4116
4	16	112	14	100
5	12	70	8	18
6	6	—	—	—

21 *Ans.* 114

20 100

21 *Proof.* 114

Pints.	Pecks.	Tons.
6124161	81371841	914214695
1711610	16791718	76971814
8716968	2716989	10768218
7169	417694	769169
168	107824	77482
4	1000	365

Bought a top for 6d., a kite for 4d., a bag of marbles for 3d., a ball for 9d., a knife for 10d., and several other playthings for 11d.; how many pence have I laid out?

*Ans.* 43.

Paid for flour 17s., for bread 21s., for cheese 17s., for butter 12s., for paper, pens, and ink, 5s., for garden seeds 2s., and for flower pots 1s.; how many shillings have I spent?

*Ans.* 75.

My mother went to a linen draper's shop and purchased the following goods, viz., 29 yards of cloth, 37 yards of calico, 17 yards of flannel, 27 yards of muslin, 109 yards of tape, 37 yards of sheeting, and 81 yards of blue fringe; how many yards did she buy in all? *Ans.* 337.



The building of St. Paul's cost £860000, the Royal Exchange (since burnt down) £80000, the Monument £218000, Blackfriars Bridge £152840, Westminster Bridge £218000, and the Mansion House £40000; what was the expense of the whole? *Ans.* £1568840.

A grazier has in his fold 247 sheep, grazing 4008, on the road to London 516, at Smithfield 1101, and at the butcher's for slaughter 310; how many has he in all? *Ans.* 6182.

A gentleman left £3200 to his widow, £5000 to his eldest son, £1225 to his second son, and £795 to his only daughter; what was the whole amount?

*Ans.* £10220.

## SIMPLE SUBTRACTION.

SIMPLE SUBTRACTION shows the difference between sums or quantities of unequal numbers.

	Bushels.	Gallons.
24656364	82769183 *	62710841
12325132	79280748	37007182
<hr/>		
12331232 <i>Ans.</i>	3488435	
<hr/>		
24656364 <i>Proof.</i>	82769183	
<hr/>		
Ounces.	Quarts.	Feet.
71691421	50171261	11712640
37110794	9712817	971006
<hr/>		

Take 1027695428 from 9871642751 and its remainder five times.

Subtract 412968143 from 9187625290 and its remainder six times.

\* The reason why you borrow 10, and place it to the upper figure is, because numbers increase in a ten-fold proportion to the left hand; as ten ones make ten, ten tens a hundred, ten hundreds a thousand, &c. You must always add 1 to the next figure, when you *do* borrow 10, and not else.

If my brother lend me 1426 marbles, and I return him 949, how many more should he have? *Ans.* 477.

Suppose I lend a friend £200; and he pays me in part £73, what is the balance between us? *Ans.* £127.

Deduct £17329 from twenty thousand pounds.  
*Ans.* £2671.

If a peach tree had 74 peaches on it, and the wind blew off three dozen and two; how many were left?  
*Ans.* 36.

A person in trade bought 7006 yards of calico, and sold to his customers 2198 yards; what quantity has he in hand?  
*Ans.* 4808 yards.

There are in the Old Testament 23214 verses, and in the New 7959; how many more are there in the former than in the latter?  
*Ans.* 15255.

## SIMPLE MULTIPLICATION.

SIMPLE MULTIPLICATION is nothing more than a short method of performing Addition.\*

In this rule there are three things to be observed:—

First, the number to be multiplied, which is called the *multiplicand*.

Secondly, the number by which you multiply, which is called the *multiplier*.

Thirdly, the number produced, which is called the *product*.

1234567890 <i>Multiplicand.</i>	416738945	148309357
2 <i>Multiplier.</i>	3	4

2469135780 *Product.*

743216953

5

954326580

4

122334455

3

\* For, instead of adding up, it is only to multiply, and the sum is done.

## SIMPLE MULTIPLICATION.

$$\begin{array}{r} 831065849 \\ 8 \end{array}$$

$$\begin{array}{r} 197621054 \\ 9 \end{array}$$

$$\begin{array}{r} 763508914 \\ 10 \end{array}$$

$$\begin{array}{r} 374200681 \\ 11 \end{array}$$

$$\begin{array}{r} 107654289 \\ 12 \end{array}$$

$$\begin{array}{r} 987654321 \\ 1200^* \end{array}$$

$$\begin{array}{r} 6 \\ 3 \times 5 \dagger \\ 6 \end{array} \begin{array}{r} 143261895 \\ 23 \end{array}$$

$$\begin{array}{r} 429785685 \\ 286523790 \\ 3295023585 \end{array}$$

$$\begin{array}{r} 176929580 \\ 436 \end{array}$$

$$\begin{array}{r} 876543215 \\ 5678 \end{array}$$

$$\begin{array}{r} 942760218 \\ 921600 \end{array}$$

$$\begin{array}{r} 726009574 \\ 670058 \end{array}$$

$$\begin{array}{r} 77606153800 \\ 700689000 \end{array}$$

$$\begin{array}{r} 176895432 \dagger \\ 13 \end{array}$$

$$\begin{array}{r} 327604981 \\ 14 \end{array}$$

$$\begin{array}{r} 116294897 \\ 16 \end{array}$$

$$\begin{array}{r} 2299640616 \end{array}$$

\* If there are noughts, or ciphers, at the right hand of the multiplicand or multiplier, or both, bring them down, and annex them to the product. See the *Sixth* following sum.

† This is the proof by casting out the *nines*, which the teacher will easily explain. But the surer method of proving the sum is to divide the product by the multiplier, and if the quotient come like the multiplicand, the operation is correct.

‡ The work, as this example shows, may be wrought in *one* line with any number under 20, by taking in the right hand figure every time you multiply.

## SIMPLE DIVISION.

7

Multiply 473653980 by 24

$$\begin{array}{r}
 473653980 \\
 \times 24 \\
 \hline
 1894615920 \\
 9473079600 \\
 \hline
 11367695520
 \end{array}$$

Multiply 987605324 by 42

$$\begin{array}{r}
 987605324 \\
 \times 42 \\
 \hline
 1975210648 \\
 39504212980 \\
 \hline
 41481712656
 \end{array}$$

Multiply 123456789 by 96.

Multiply 921067854 by 144.

If the multiplicand is 719326187, and the multiplier 748, what is the product? *Ans.* 538055987876.

A gentleman has coming in £40 a week, how much is that in one year, or 52 weeks? *Ans.* £2080.

How many marbles must I have, to give 36 boys 11 each? *Ans.* 396.

How many hours has a boy or girl lived who is ten years old? *Ans.* 87660.

What is the amount of a thousand thousand?

*Ans.* 1000000.

What time is gained by a person who rises at 5 o'clock in the morning, instead of 8, during a life of 80 years, reckoning 365 days to the year?

*Ans.* 87600 hours.

A person laid by £2 a week; what did he save in 15 years? *Ans.* £1560.

## SIMPLE DIVISION.

SIMPLE DIVISION shows how often one number is contained in another.

The *divisor* is the number you divide by; the *dividend* is the number to be divided; the *quotient* is the number produced by division; and what is over is called the *remainder*.

Divisor.	Dividend.		
2 )	469837153	3 )	769311046
			4 )
			11614207
Quotient	234918576—1 rem.		
	2		

Proof 469837153\*

5 )	756945628	6 )	764284361	7 )	111110004
8 )	887766554	9 )	100100111	10 )	717122210
11 )	746278432916	12 )	111226400521		

Divide 476270533 by 24.

Divide 211642691 by 45.

$$24 \left\{ \begin{array}{l} 6 ) \underline{476270533} \\ 4 ) \underline{79378422-1} \\ 19844605-2 \end{array} \right\} 13\frac{1}{2}$$

$$45 \left\{ \begin{array}{l} 9 ) \underline{211642691} \\ 5 ) \underline{\hspace{1cm}} \end{array} \right.$$

Divide 112461893 by 54.

Divide 654321045 by 121.

Divide 712468912 by 72.

Divide 742684325 by 144.

Divide 365068140 by  $1\frac{1}{2}$ .

Divide 234675432 by  $4\frac{1}{2}$ .

$$\begin{array}{r} 1\frac{1}{2} \quad 365068140 \\ 4 \qquad \qquad 4 \end{array}$$

$$\begin{array}{r} 4\frac{1}{2} \quad 234675432 \\ 2 \qquad \qquad 2 \end{array}$$

New Divisor 5 ) 1460272560 New Div<sup>d</sup>.

9 ) 469350864

$$\underline{292054512}$$

$$\underline{52150096}$$

Divide 123740045 by  $2\frac{1}{2}$ .

\* Unless the proof agree with the top line, or *dividend*, the sum is wrong.

† This is found by multiplying the first divisor 6 by the last remainder 2, and adding in the first remainder 1, which makes the whole remainder 13.

## SIMPLE DIVISION.

9

Divis.	Dividend.	Quotient.
13)	14164841(	1089603
13.....		13
	116	3268809
	104	1089603
		2 remainder.
	• 124	118
	117	14164841 proof.
		115
	•• 78	•• 33
	78	23
	•• 41	104
	39	92
	• 2 remainder.	121
		115
		•• 65
		46
		19

37) 147637650 (	75) 942654311 (
123) 111464923 (	2193) 714169213 (
1763) 512769814 (	9210) 700411416 (
73000) 117142690 (	8765) 672111161029 (

If the dividend be 404724042928858, and the quotient 85420861741, what is the divisor? *Ans.* 4738.

What is the quotient of 209316854128 divided by 436? *Ans.* 480084527—356 *rem.*

The earth is said to travel at the rate of 68000 miles an hour; what distance is that per minute? *Ans.* 1133 *miles*—20 *rem.*

\* Here the *noughts* are equally cut off, and do not interfere with the working of the sum.

What number is that which multiplied by 217 will make the product 4528573? *Ans.* 20869.

## COMPOUND ADDITION.

COMPOUND ADDITION brings sums of different names or denominations into one whole or total amount.

A farthing is expressed thus,  $\frac{1}{4}$ ; a halfpenny thus,  $\frac{1}{2}$ ; and three-farthings thus,  $\frac{3}{4}$ .

f.	d.	s.	d.	£	s.	d.
$\frac{1}{4}$	6	1	$6\frac{1}{4}$	4	14	$6\frac{1}{4}$
$\frac{1}{4}$	$4\frac{1}{2}$	2	4			
$\frac{3}{4}$	3	7	10	1	10	2
$\frac{1}{4}$	$1\frac{1}{2}$	6	6	1	16	$2\frac{1}{2}$
$\frac{1}{4}$	6	0	7	6	11	$10\frac{1}{2}$
$\frac{1}{4}$	11	0	$2\frac{1}{4}$	4	16	11
$\frac{3}{4}$	$10\frac{3}{4}$	0	$1\frac{3}{4}$	6	14	$9\frac{1}{4}$
				9	6	$4\frac{3}{4}$
$3\frac{1}{2}$ <i>Ans.</i>	$3\ 6\frac{1}{2}$	19	$1\frac{1}{2}$	35	10	$10\frac{1}{2}$ <i>Ans.*</i>

30 16 4

35 10  $10\frac{1}{2}$  *Prf.*

£	s.	d.	£	s.	d.	£	s.	d.
27	16	10	1614	19	$2\frac{1}{2}$	71168	3	$3\frac{1}{2}\dagger$
17	19	6	2110	10	0	1711	6	4
4	17	$11\frac{1}{2}$	171	6	$10\frac{1}{2}$	1416	1	10
3	3	0	11	11	9	900	7	10
1	1	$11\frac{1}{2}$	11	17	$4\frac{3}{4}$	148	11	6
0	19	$6\frac{1}{2}$	1	1	3	719	8	11
0	0	$3\frac{3}{4}$	0	2	6	10	4	3

\* Here it may be plainly seen and understood that 1 is carried for every 4 in farthings, 1 for every 12 in pence, and 1 for every 20 in shillings; because 4 farthings make a penny, 12 pence one shilling, and 20 shillings one pound.

† It seems quite unnecessary to multiply sums like these, as the teacher generally sets the first line in a book, and then completes the sum by

A boy spent in cakes  $7\frac{1}{2}$ d., in marbles 2s. 3d., in dumps and tops  $3\frac{1}{2}$ d., and for several other things 3s.  $11\frac{1}{2}$ d.; how much did he spend in all? *Ans.* 7s.  $1\frac{1}{2}$ d.

A corn factor owes a farmer for wheat £912 14s. 2d., for barley £254 0s.  $4\frac{1}{2}$ d., for rye £104 19s.  $1\frac{1}{2}$ d., for beans £342 14s.  $7\frac{1}{2}$ d., and for peas £576 19s.  $10\frac{1}{2}$ d.; what is the whole debt? *Ans.* £2191 8s.  $1\frac{1}{2}$ d.

My father's last week's expenses amounted to the following sums: meat £1 17s. 6d., bread £1 0s.  $10\frac{1}{2}$ d., flour 17s. 10d., vegetables 4s.  $8\frac{1}{2}$ d., tea and sugar £1 0s. 6d., butter and cheese 4s. 7d., letters and parcels 2s. 10d., and a quarter's wages of £3 10s. to the housemaid; what was the whole expenditure?

*Ans.* £8 18s.  $10\frac{1}{2}$ d.

A grocer has in his warehouse sugar worth £500, teas of different sorts and qualities valued at £88 16s. 1d., currants worth £35, spices £37 19s.  $1\frac{1}{2}$ d., rice 40 guineas and a half, and various other articles to the amount of £209 17s.  $8\frac{1}{2}$ d.; what is the value of the whole stock in trade? *Ans.* £914 3s.  $0\frac{1}{2}$ d.

## COMPOUND SUBTRACTION

COMPOUND SUBTRACTION teaches to find the difference of two sums of different denominations.

	£	s.	d.		£	s.	d.		£	s.	d.
From	42	10	$6\frac{1}{2}$	Lent	19	17	$6\frac{1}{2}$ *	Borrowed	100	0	0
Take	11	5	$2\frac{1}{2}$	Rec <sup>d</sup> .	16	18	$9\frac{1}{2}$	Paid	83	15	6
Diff.	31	5	$4\frac{1}{2}$	Diff.	2	18	$8\frac{1}{2}$	Balance	16	4	6
Proof	42	10	$6\frac{1}{2}$	Proof	19	17	$6\frac{1}{2}$	Proof	100	0	0

adding more figures on a slate, which, when done, the young scholar enters into his ciphering book.

\* When the lower figure cannot be taken from the upper, if in farthings borrow 4, in pence 12, and in shillings 20, taking care to carry 1 every time you have occasion to borrow. The pounds are worked like Simple Subtraction.



£	s.	d.	£	s.	d.	£	s.	d.
627	11	6	417	11	6	501	11	2½
179	17	10	79	17	8½	71	13	1
<hr/>			<hr/>			<hr/>		
7171	10	1	1110	11	0½	9140	11	3½
469	0	0½	71	9	8½	9	19	11½
<hr/>			<hr/>			<hr/>		

	£	s.	d.		£	s.	d.
Lent	9000	0	0	Borrowed	500	15	6
Received at different times.	<div> <div>{</div> <div>4000 15 6</div> <div>1710 16 6</div> <div>812 7 0</div> <div>100 0 0</div> <div>77 14 10</div> <div>10 10 0</div> <div>5 5 0</div> </div>			Paid at sundry times.	<div> <div>{</div> <div>200 0 0</div> <div>23 15 6</div> <div>79 10 0</div> <div>36 19 6</div> <div>2 10 0</div> <div>1 0 0</div> </div>		
Received in all	<hr/>			Paid in all	<hr/>		
Remain <sup>r</sup> . due	<hr/>			Rem. unpaid	<hr/>		
Proof	<hr/>			Proof	<hr/>		

Take £1167527 11s. 2½d. from £9972407 10s. 4½d. and its remainder four times.

Subtract £1062781 16s. 0½d. from £9870061 and its remainder six times.

I lent one of my schoolfellows a sovereign, and he has paid me in part 13s. 10½d.; how much does he owe me?

*Ans.* 6s. 1½d.

If I send a five pound Bank of England note to discharge a bill of £3 17s. 8½d.; what change shall I have out of it?

*Ans.* £1 2s. 3½d.

My uncle made me a present of half a sovereign, and I bought a book for 3s. 6d. and a penknife for half-a-crown; how much money had I left?

*Ans.* 4s.

If the debtor side of an account be £4271 13s. 6d., and the creditor side £987 19s. 7½d., what is the balance?  
*Ans.* £3283 13s. 10½d.

What is left out of £10 after paying for linen £2 10s. 8½d., shoes and boots £2 5s. 6d., and other things £1 19s. 10½d.? *Ans.* £3 3s. 11d.

## COMPOUND MULTIPLICATION.

COMPOUND MULTIPLICATION teaches the method of multiplying sums or quantities of more than one denomination.

To find the price of a ¼, ½, or ¾, take parts of the given price, and add them up with the other figures.

$\begin{array}{r} \text{s. d.} \\ 0 \ 7\frac{1}{2} \\ \underline{2} \end{array}$	$\begin{array}{r} \text{s. d.} \\ 1 \ 9\frac{1}{2} \\ \underline{3} \end{array}$	$\begin{array}{r} \text{£ s. d.} \\ \frac{1}{4} ) \ 4 \ 16 \ 8 \\ \underline{4\frac{1}{2}} \end{array}$
$\text{Ans. } \underline{\underline{1 \ 2\frac{1}{2}}}$	$\text{Ans. } \underline{\underline{5 \ 4\frac{1}{2}}}$	$\begin{array}{r} 19 \ 6 \ 8 \\ \underline{1 \ 4 \ 2} \\ \text{Ans. } 20 \ 10 \ 10 \end{array}$

$\begin{array}{r} \text{£ s. d.} \\ \frac{1}{2}   \frac{1}{2} ) \ 5 \ 12 \ 6\frac{1}{2} \\ \underline{5\frac{1}{2}} \\ 28 \ 2 \ 8\frac{1}{2} \\ \underline{2 \ 16 \ 3\frac{1}{2}} \\ 30 \ 18 \ 11\frac{1}{2} \end{array}$	$\begin{array}{r} \text{£ s. d.} \\ \frac{1}{2}   \frac{1}{2} ) \ 8 \ 12 \ 4\frac{1}{2} \\ \underline{6\frac{1}{2}} \\ 51 \ 14 \ 3 \\ \underline{\frac{1}{2}   \frac{1}{2} ) \ 4 \ 6 \ 2\frac{1}{2}} \\ \underline{2 \ 3 \ 1} \\ 58 \ 3 \ 6\frac{1}{2} \end{array}$	$\begin{array}{r} \text{£ s. d.} \\ 38 \ 17 \ 6\frac{1}{2} \\ \underline{7} \\ 719 \ 11 \ 0\frac{1}{2} \\ \underline{8} \end{array}$
---	---	--

$\begin{array}{r} \text{£ s. d.} \\ 719 \ 11 \ 0\frac{1}{2} \\ \underline{8} \end{array}$	$\begin{array}{r} \text{£ s. d.} \\ 1171 \ 19 \ 6\frac{1}{2} \\ \underline{9} \end{array}$	$\begin{array}{r} \text{£ s. d.} \\ 97141 \ 17 \ 10\frac{1}{2} \\ \underline{10} \end{array}$
---	--	---

£	s.	d.	£	s.	d.	
$\frac{1}{8}$ )	4713	17 0 $\frac{1}{2}$	$\frac{4}{8}$   $\frac{1}{8}$ )	5716	10 6 $\frac{1}{2}$	Or for $\frac{1}{8}$ multi-
		11 $\frac{1}{2}$			12 $\frac{1}{2}$	ply the top
						line by 5, and
			$\frac{1}{8}$   $\frac{1}{8}$ )			divide by 8,
						which add to
						the rest.

Value 13 feather beds at £4 14s. 4d. each.

*Ans.* £61 6s. 4d.

If one load of meadow hay cost £4 17s. 6d., what will 15 loads come to?

*Ans.* £73 2s. 6d.

Find the cost of 18 tons of coals at 37s. 6d. per ton.

*Ans.* £33 15s.

If a workman earn 3s. 6d. per day, what will be due to him in 20 days?

*Ans.* £3 10s.

What will two dozen ciphering books come to at 3s. 9d. each?

*Ans.* £4 10s.

Suppose a bullock cost £18 17s., what would 30 cost at the same price?

*Ans.* £565 10s.

What will 42 cherry trees come to at 5s. 4 $\frac{1}{2}$ d. each?

*Ans.* £11 5s. 9d.

If a china jug cost 11s. 5d. what would 64 be worth?

*Ans.* £36 10s. 8d.

Find the price of 65 china bowls at 28s. 3d. per bowl.

*Ans.* £91 16s. 3d.

At 2s. 8d. for a gallon of ale, what must be given for 74 gallons?

*Ans.* £9 17s. 4d.

At 5s. 4d. for a stone of veal, how much for 95 stone?

*Ans.* £25 6s. 8d.

Value 101 barrels of beer at £3 13s. 8d. per barrel.

*Ans.* £372 0s. 4d.

What will 128 hogsheads of cider come to at £7 17s. 2d. per hhd.?

*Ans.* £1005 17s. 4d.

What is the value of 134 gold watches at 20 $\frac{1}{2}$  guineas each?

*Ans.* £2884 7s.

Suppose an ounce of silver cost 5s. 4½d. what cost 142½ ounces? *Ans.* £38 7s. 6½d.

If a yard of cloth cost 2s. 11½d. what did 149½ yards come to? *Ans.* £22 2s. 3½d.

What are 154½ loads of manure worth at 5s. 10d. a load? *Ans.* £45 2s. 8½d.

Value 168 \* sheep at 58s. 9d. per head.

*Ans.* £493 10s.

Find the cost of 173½ pieces of serge at £1 11s. 7½d. per piece. *Ans.* £274 6s. 11½d.

What is the price of 189½ reams of paper at 23s. 8½d. per ream? *Ans.* £224 18s. 7½d.

What must be given for 200 bay mares at 45 guineas each? *Ans.* £9450.

If a freehold tenement be sold for £217 11s. 6d. what would 232 be worth? *Ans.* £50477 8s.

Value a thousand store pigs at 55s. 8d. each.

*Ans.* £2783 6s. 8d.

What will 5428½ lb. of honey come to at 3s. 1d. per lb.? *Ans.* £836 17s. 10½d.

Find the value of 10426 freehold cottages at £89 15s. 6d. each. *Ans.* £935994 3s.

Value 1½ barrel of beer at 16d. a gallon.

*Ans.* £3 12s.

1 barrel = 36 gal.

½ ditto = 18

16 = 1 4  
9

54 gallons, at 16d. per gal. 12 0  
6

*Ans.* £3 12 0

\* If the number is above 156, the work is generally best performed by *Practice*, but may be done by Multiplication, first multiplying by 100, and then by 10 or 1, as the case may require, and, lastly, adding up the whole together for the answer, or full amount.

What are two tons of potatoes worth at 3s. 6d. per cwt. ?  
*Ans. £7.*

Pay a man for 17 weeks' work (reckoning six days to the week) at 2s. 9d. a day.  
*Ans. £14 0s. 6d.*

What are 20 quarts of beer worth at 2d. per pint?  
*Ans. 6s. 8d.*

What will a barrel and a half of beer cost at 3d. per pint?  
*Ans. £5 8s.*

What are 1000 quarts of ale worth at 2s. 6d. a gallon?  
*Ans. £31 5s.*

Bought 40 bushels of peas at 1s. 3d. a peck; what did they come to?  
*Ans. £10.*

Multiply £100 by  $4\frac{1}{8}$ ,  $5\frac{1}{4}$ , and  $6\frac{3}{8}$ .  
*Ans. £412 10s.; £525; £662 10s.*

What must be paid for  $4\frac{1}{4}$  dozens of port wine, at 3s. 6d. a bottle?  
*Ans. £8 18s. 6d.*

Value  $2\frac{3}{4}$  tons of potatoes at  $1\frac{1}{2}$ d. per lb.  
*Ans. £38 10s.*

What will a year's wages come to at 3s. 10d. a week?  
*Ans. £9 19s. 4d.*

Eighteen stone and a half of meat at  $7\frac{1}{2}$ d. per lb.;  $2\frac{1}{2}$  hhds. of ale at  $4\frac{1}{2}$ d. per quart; 1 cwt. of soap at  $7\frac{1}{2}$ d. per lb.; 1 firkin of butter at  $11\frac{3}{4}$ d. per lb.; and 2 qrs.  $11\frac{1}{2}$  lb. of starch at  $10\frac{1}{2}$ d. per lb.  
*Ans. £4 12s. 6d.; £10 2s. 6d.; £3 10s.; £2 14s. 10d.; and £2 19s. 0 $\frac{1}{2}$ d.*

If I put by  $1\frac{3}{4}$ d. per day, how much shall I have at the year's end?  
*Ans. £2 5s. 7 $\frac{1}{2}$ d.*

If Madeira be sold at 11s.  $11\frac{1}{2}$ d. a gallon, what is it a tun?  
*Ans. £150 13s. 6d.*

What is the cost of 530 lbs. of tea at 4s. 4d. per lb?  
*Ans. £114 16s. 8d.*

What is the value of the talent which contained 6000 drachmæ, if one drachma was worth  $7\frac{1}{2}$ d. ?  
*Ans. £193 15s.*

## COMPOUND DIVISION.

COMPOUND DIVISION teaches to divide any given sum or quantity by a whole number.

$\begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 2) 4 \quad 7 \quad 6\frac{1}{2}^* \end{array}$	$\begin{array}{r} \text{s.} \quad \text{d.} \\ 3) 11 \quad 9 \end{array}$	$\begin{array}{r} \text{s.} \quad \text{d.} \\ 4) 10 \quad 6 \end{array}$	$\begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 5) 11 \quad 14 \quad 6\frac{1}{2} \end{array}$
$\text{Ans.} \quad 2 \quad 3 \quad 9\frac{1}{2}$			
2			

*Proof.*  $\begin{array}{r} 4 \quad 7 \quad 6\frac{1}{2} \\ \hline \end{array}$

$\begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 6) 121 \quad 0 \quad 6 \end{array}$	$\begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 7) 7716 \quad 9 \quad 10\frac{1}{2} \end{array}$	$\begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 8) 11161 \quad 0 \quad 11 \end{array}$

If 10 yards of muslin cost £2 17s. 10d., what cost 1 yard?

*Ans.* 5s. 9½d. ⅞.

At £17 16s. 6d. for 11 pair of boots, what cost 1 pair?

*Ans.* £1 12s. 4¾d. ⅞.

What is the price of a pound of veal, if 12 lb. cost 8s. 6d.?

*Ans.* 8½d.

Divide £300 into 14 equal shares.

*Ans.* £21 8s. 6¾d.

Suppose 16lb. of butter cost 14s. 8d., what did 1 lb. cost?

*Ans.* 11d.

What is the 18th part of one hundred guineas?

*Ans.* £5 16s. 8d.

\* What is over in pounds (if any) bring into shillings; what is over in shillings, bring into pence; and what is over in pence, bring into farthings.

Divide the sum of £500 into 22 equal parts.

*Ans.* £22 14s. 6½d.

If 24 pieces of cloth cost £110, what cost 1 piece?

*Ans.* £4 11s. 8d.

What is the price of a tub of butter, if 60 tubs cost £121?

*Ans.* £2 0s. 4d.

Sold 66 hearth rugs for £199 15s. 6d., what was the price of 1?

*Ans.* £3 0s. 6½d.

If a workman receive £97 10s. for 72 weeks' employment, how much was that weekly?

*Ans.* £1 7s. 1d.

If I give £10 for 90 pair of hose, what is that a pair?

*Ans.* 2s. 2½d.

Required the price of a gallon of vinegar, when 96 gallons cost £16?

*Ans.* 8s. 4d.

What must I give for a hundred weight of coals, if 99 cwt. cost 11 guineas?

*Ans.* 2s. 4d.

If 108 bottles of brandy cost £21 12s., what is the price of a single bottle?

*Ans.* 4s.

Divide ten thousand pounds into 121 equal moieties.

*Ans.* £82 12s. 10½d.

Find the answer of £4261 11s. 9¼d., divided by 111.\*

*Ans.* £38 7s. 10½d.

Let £24 10s. 6½d. be multiplied by ¼, ½, and ¾.

*Ans.* £6 2s. 7½d.; £12 5s. 3½d.; £18 7s. 10¾d.

Divide £510 16s. 6d. by 4½.

*Ans.* £110 8s. 11½d. ¾.

What is cheese per lb. at 56s. per hundred weight?

*Ans.* 6d.

If 4 stone of pork cost £1 2s. 8d., what is 1 lb. worth?

*Ans.* 8½d.

\* This and several other examples which follow, will exemplify the nature or practice of Long Division of Money; but if it be judged desirable, the instructor will find no difficulty in introducing a greater variety of a more common and simple application than those already exhibited.

What are spelling-books a dozen, when  $104\frac{1}{2}$  dozen cost £51 16s. 9d. ?

*Ans.* 9s. 11d.

Bought  $85\frac{1}{4}$  yards of superfine grey cloth for £75 16s. 8d., what did it cost me per yard ?

*Ans.* 17s. 8d.  $\frac{4}{3}$ .

Tell the price of butter per lb., when  $198\frac{1}{4}$  lb. cost £11 11s. 4d.

*Ans.* 1s. 2d.  $\frac{2}{3}$ .

Required the price of a gallon of wine, at £60 15s., for 2 hhds. 35 gals.

*Ans.* 7s. 6 $\frac{1}{2}$ d.  $\frac{3}{8}$ .

If 364 gals. 3 qt. of Irish whisky can be bought for £109 15s., what is a quart worth ?

*Ans.* 1s. 6d.  $\frac{7}{8}$ .

If I have a yearly income of £100, what may I spend a day ?

*Ans.* 5s. 5 $\frac{1}{2}$ d.  $\frac{5}{8}$ .

Suppose 19 hundred quills cost £6 7s. 10d., at what rate is that a hundred ?

*Ans.* 6s. 8 $\frac{1}{2}$ d.  $\frac{1}{10}$ .

What is the twenty-third part of a £50 bank of England note ?

*Ans.* £2 3s. 5 $\frac{1}{2}$ d.  $\frac{1}{3}$ .

If a clerk in a merchant's counting-house is paid 80 guineas a year for his services, what is his weekly salary ?

*Ans.* £1 12s. 3 $\frac{1}{2}$ d.  $\frac{1}{4}$ .

Divide £1720 10s. 6d., by  $19\frac{1}{2}$ . *Ans.* £88 16s.  $\frac{1}{3}$ .

Divide £2000, by  $42\frac{1}{10}$ . *Ans.* £47 10s.  $1\frac{1}{2}$ d.  $\frac{1}{10}$ .

Let £10,000 and 100 guineas be divided by  $13\frac{1}{2}$ .

*Ans.* £739  $\frac{1}{4}$ .

How much ought a person to lay by every day, who wishes to make up the sum of £150 in a year ?

*Ans.* 8s. 2 $\frac{1}{2}$ d.  $\frac{1}{10}$ .

Divide a prize of £5876 10s. equally amongst 168 sailors, after deducting  $\frac{1}{4}$ th for the captain and officers.

*Ans.* £27 19s. 8d.

Divide £57 15s. among 5 men and 6 boys, giving each man thrice the share of a boy.

*Ans.* A man's share £8 5s.; a boy's £2 15s.



## ADDITION OF WEIGHTS AND MEASURES.

### TROY WEIGHT.\*

lbs.	oz.	dwt.	gr.	lbs.	oz.	dwt.	gr.
126	10	15	20	134	9	2	0
117	8	16	16	271	11	16	10
169	6	8	10	162	6	10	6
16	4	8	10	761	0	11	6
19	2	6	14	100	3	12	19
8	11	15	8	41	2	14	12

A jeweller bought as follows:—11 lbs. 1 oz. 10 gr. of gold; 13 lb. 10 oz. 15 dwt. of gold rings; 4 lb. 15 dwt. of silver watch cases; 5 lb. 1 oz. 21 gr. of Spanish dollars; 1 lb. 2 oz. 17 dwt. 13 gr. of different pieces of silver; and  $37\frac{1}{2}$  lb. of foreign coin; what is the weight of the whole?

*Ans.* 72 lb. 10 oz. 8 dwt. 20 gr.

### AVOIRDUPOIS WEIGHT.

tons.	cwt.	qr.	lb.	cwts.	qr.	lb.	oz.
162	14	3	16	116	0	15	14
116	10	2	10	141	1	16	6
142	3	0	17	200	2	21	8
76	6	1	8	111	3	6	7
81	6	3	10	34	0	10	11
9	2	1	21	1	2	19	0

A grocer sold 1 cwt. 2 qr. 14 lb. of lump sugar; 1 qr.  $11\frac{1}{2}$  lb. of green tea; 2 qr. 17 lb. 1 oz. of black tea; 3 qr. 15 lb. of spices; 17 lb. 13 oz. of moist sugar; and 2 qr.  $10\frac{1}{2}$  lb. of rice; what quantity of goods did he dispose of?

*Ans.* 4 cwt. 1 qr. 1 lb. 14 oz.

\* Let the table be repeated before the operation is begun, and so in like manner with the rest, whether in Addition, Subtraction, Multiplication, or Division.

APOTHECARIES' WEIGHT.

lbs.	oz.	dr.	sc.	oz.	dr.	sc.	gr.
164	10	5	2	169	5	2	18
111	11	4	1	110	6	1	19
712	6	7	1	417	1	1	10
117	8	0	0	116	2	0	6
41	2	2	1	300	4	2	4
4	0	4	0	27	0	2	15

An apothecary mixed the following ingredients together :—Epsom salts, weighing 2 lb. 3 oz. ; rhubarb  $1\frac{1}{2}$  lb. ; senna 1 lb. 2 oz. 1 scr. 15 gr. ; magnesia 10 oz. 2 scr. 15 gr. ; jalap 2 lb. 15 gr. ; and gum ammoniac 1 oz. 1 scr. 18 gr. ; what is the weight of the whole ?

*Ans.* 7 lb. 10 oz. 2 dr. 1 scr. 3 gr.

WOOL WEIGHT.

lasts.	sa.	wey.	tod.	weys.	tod.	st.	clo.
141	8	1	4	171	4	1	1
171	7	0	3	111	0	0	1
216	10	1	0	47	6	0	1
471	9	1	2	36	4	1	0
31	6	0	5	18	5	0	1
4	4	1	2	3	1	1	1

CLOTH MEASURE.

yards.	qr.	na.	in.	ells	Eng.	qr.	na.	in.
110	3	2	1	126	3	2	0	
217	1	1	0	101	2	1	0	
116	1	1	0	116	2	1	0	
14	2	0	0	315	0	3	0	
8	0	3	0	114	0	3	1	
2	3	2	$1\frac{1}{4}$	21	1	0	$0\frac{1}{4}$	

I bought 92 yards 2 qr. of Irish linen; 15 yds. 3 qr. 1 na. of coarse sheeting; 21 yds. 1 qr. of flannel; 11 yds. 2 qr. 1 na.  $1\frac{1}{4}$  in. of print;  $11\frac{1}{4}$  yds. of fine calico; and  $15\frac{1}{4}$  yds. of muslin; tell me what quantity I have to pay for?

*Ans.* 167 yds. 3 qr. 2 na.  $1\frac{1}{4}$  in.

## ALE AND BEER MEASURE.\*

butts.	hhd.	bar.	kil.	hhds.	gal.	qt.	pt.
117	1	1	1	164	50	3	1
71	1	0	1	112	18	3	1
10	1	0	1	141	7	2	0
9	0	1	0	10	16	0	0
8	0	1	0	11	14	0	1
3	1	1	1	12	28	1	1

A publican received at one time 2 butts, 1 hhd. 2 bar. 8 gallons of porter; at another 1 hhd. 18 gal. 3 qt.; at another 4 barrels; at another  $3\frac{1}{2}$  hogsheads; at another 1 butt, 18 gallons; and at another  $2\frac{1}{2}$  barrels; how many butts, hhds., &c. did he have in all?

*Ans.* 8 butts, 1 hhd. 1 bar. 17 gal. 3 qts.

## WINE MEASURE.

pipes.	hhd.	gal.	qt.	hhds.	gal.	qt.	pt.
141	1	21	3	116	11	2	1
61	1	16	2	100	16	1	1
18	1	10	1	41	29	1	1
5	0	6	1	4	34	0	1
4	0	9	3	6	2	0	0
1	1	3	0	9	6	2	0

A wine merchant has the following wines and spirits in his cellar:—2 pipes of port; 1 hhd. 10 gal. 1 qt. of

\* Whether it be Ale or Beer, there are 36 gallons to the barrel, and 9 to the firkin.

sherry; 1 hhd. 15 gal. 1 pt. of cider; 1 pipe, 1 hhd. 3 qt. of Madeira; 19 gal. 3 qt. 1 pt. of brandy; 50 gal. of rum; and  $10\frac{1}{2}$  gal. of gin; what is the whole quantity?  
*Ans.* 5 pipes, 0 hhd. 43 gal. 2 qt. 0 pt.

### LONG MEASURE.

miles.	fur.	po.	yd.	poles.	yd.	ft.	in.
161	0	30	2	126	0	1	3
111	2	31	0	131	0	1	3
417	6	18	0	411	0	2	3
500	3	3	2	716	0	2	0
671	4	9	0	10	0	1	6
378	1	18	$1\frac{1}{2}$	12	0	1	0

From London to Deptford is 4 mi. 2 fur.; from Deptford to Crayford 10 mi.; from Crayford to Dartford 2 mi.; from Dartford to Chalk-street 9 mi.; from Chalk-street to Rochester 6 mi. 2 fur. 20 po.; from Rochester to Sittingbourne 10 mi. 2 fur. 10 po.; from Sittingbourne to Bocton-street 10 mi.; from Bocton-street to Canterbury 6 mi.; and from Canterbury to Dover 15 miles; how far is it from London to Dover?

*Ans.* 72 mi. 6 fur. 30 po.

### DRY MEASURE.

qrs.	bu.	pk.	gal.	bus.	pk.	gal.	qt.
120	1	2	1	141	2	1	3
141	2	3	1	111	3	1	2
111	6	0	1	171	1	1	1
714	3	0	0	211	1	0	1
41	0	3	0	6	1	0	1
16	4	1	1	2	0	1	0

Sent to market 15 qrs. 3 bus. 1 pk. of flour ; 19 b 3 pk. of oatmeal ; 11 qrs. 1 gal. of pollard ; 2 qrs. 1 b 3 pk. 1 gal. of hemp seed ; 3 qrs. of bran ; and  $7\frac{1}{2}$  b of peas ; I demand the whole quantity ?

*Ans.* 35 qrs. 0 bus. 2 pk. 0 ga

### SUPERFICIAL MEASURE.

acres.	r.	po.	rods.	po.	yd.	ft.
217	3	30	117	31	0	0
111	2	14	141	14	0	1
471	2	10	71	20	0	0
36	1	8	41	0	4	1
14	1	5	6	0	0	0
10	3	0	9	18	0	0

### CUBIC OR SOLID MEASURE.

yards.	feet.	in.	yards.	feet.	in.
511	19	1001	216	14	141
141	16	711	141	20	511
171	20	116	312	16	716
314	14	41	116	14	200
110	1	10	14	13	14
69	0	3	10	11	13

A surveyor having measured six pieces of land, found one to contain 8 ac. 2 r. 15 po. ; a second 11 ac. 10 p a third  $15\frac{1}{2}$  acres ; a fourth 22 ac. 1 r. 19 po. ; a fifth 12 ac. 2 r. 18 po. ; and a sixth 17 ac. 2 r.  $11\frac{1}{2}$  po. ; how many acres, &c. were surveyed ?

*Ans.* 87 ac. 2 r.  $33\frac{1}{2}$  p

## TIME.

years.	mo.	wk.	da.	days.	ho.	min.	sec.
191	8	3	6	121	15	50	54
161	10	2	1	100	6	21	16
211	11	1	4	61	7	13	21
371	6	0	0	14	10	41	6
48	0	0	3	12	16	6	6
3	2	3	2	1	4	0	12
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## SUBTRACTION OF WEIGHTS AND MEASURES.

## TROY WEIGHT.

lbs.	oz.	dwt.	gr.	lbs.	oz.	dwt.	gr.
300	8	16	21	521	6	15	14
71	9	18	23	271	1	17	18
<hr/>				<hr/>			
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From 700 lb. 18 gr. of gold, take 527 lb. 3 oz. 11 dwt. 19 gr.

## AVOIRDUPOIS WEIGHT.

tons.	cwt.	qr.	lb.	cwts.	qr.	lb.	oz.
371	18	3	15	370	2	19	14
171	17	3	19	17	0	22	0
<hr/>				<hr/>			
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Bought 4 tons 3 cwt. 1 qr. 14 lb. of cheese, and sold 3 tons 2 cwt. 19 lb.; what have I in hand?

## APOTHECARIES' WEIGHT.

lbs.	oz.	dr.	sc.	oz.	dr.	sc.	gr.
841	10	7	1	417	2	2	18
79	0	7	2	179	0	2	19
<hr/>				<hr/>			
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From 18 lb. 7 oz. of medicine, take 15 lb. 2 oz. 6 dr.  
2 sc. 1 gr.

## WOOL WEIGHT.

lasts.	sk.	wy.	td.	sk.	wy.	td.	st.
117	6	1	4	110	1	5	1
61	0	1	5	17	1	4	0
<hr/>				<hr/>			
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## CLOTH MEASURE.

yards.	qr.	na.	in.	ells Eng.	qr.	na.	in.
528	2	3	0	511	4	2	0
117	3	2	1	91	2	3	1
<hr/>				<hr/>			
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If I take 998 yds. 3 qr. 1 na. of cloth from 1796 yds.,  
what will be left?

## ALE AND BEER MEASURE.

bars.	fir.	gal.	qt.	hhd.	gal.	qt.	pt.
361	3	7	3	121	50	3	0
171	3	8	2	71	51	0	1
<hr/>				<hr/>			
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Subtract 9 bar. 8 gal. 2 qt. of ale from 18 bar. 3 qt.  
1 pt.

## WINE MEASURE.

hhd.	gal.	qt.	pt.	pipes.	hhd.	gal.	qt.
811	60	3	1	111	0	48	2
179	62	0	0	74	1	49	3
<hr/>				<hr/>			
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From a cask of brandy, containing 34 gals. 2 qt., take 19 gals. 3 qt. 1 pt.

## LONG MEASURE.

leagues.	mi.	fur.	po.	mi.	fur.	po.	yd.
311	2	7	31	171	5	30	0
114	2	7	38	99	6	38	4
<hr/>				<hr/>			
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From 600 leagues 1 mi. 10 po., take 511 leagues 2 mi. 7 fur. 1 po.

## DRY MEASURE.

qrs.	bus.	pk.	gal.	loads.	qr.	bus.	pk.
121	7	0	1	164	4	6	0
94	7	3	0	102	4	7	3
<hr/>				<hr/>			
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Take the difference between 17 loads 3 qr. 5 bus. of wheat, and 18 loads 7 bus. 3 pk.

## TIME.

years.	mo.	wk.	da.	mo.	wk.	da.	ho.
417	4	3	2	411	3	5	20
179	5	3	6	91	0	6	20
<hr/>				<hr/>			
<hr/>				<hr/>			

If 476 yrs. 3 m. 7 ho. be taken from 500 yrs., what number of years, &c. will remain?



# MULTIPLICATION OF WEIGHTS AND MEASURES.

## TROY WEIGHT.

lbs.	oz.	dwt.	gr.	lbs.	oz.	dwt.	gr.
371	8	18	21	17	11	0	11
			2.				3
<hr/>				<hr/>			
<hr/>				<hr/>			

## AVOIRDUPOIS WEIGHT.

tons.	cwt.	qr.	lb.	cwts.	qr.	lb.	oz.
141	18	3	21	59	3	17	12
			4				5
<hr/>				<hr/>			
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## APOTHECARIES' WEIGHT.

lbs.	oz.	dr.	sc.	oz.	dr.	sc.	gr.
271	10	7	2	110	4	1	15
			6				7
<hr/>				<hr/>			
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## CLOTH MEASURE.

yards.	qr.	na.	in.	ells Eng.	qr.	na.	in.
114	2	3	0	138	4	3	0
			8				9
<hr/>				<hr/>			
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## ALE AND BEER MEASURE.

hhds.	gal.	qt.	pt.	bars.	gal.	qt.	pt.
141	50	3	1	214	31	2	1
			10				11
<hr/>				<hr/>			
<hr/>				<hr/>			

## WINE MEASURE.

pipes. hhd. gal. qt.  
 318 1 61 3  
 11

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hhds. gal. qt. pt.  
 348 19 3 1  
 12

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## LONG MEASURE.

leagues. mi. fur. po.  
 228 2 7 30  
 6

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mi. fur. po. yd.  
 148 6 32  $2\frac{1}{2}$   
 7

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## DRY MEASURE.

qrs. bus. pk. gal.  
 168 7 3 1  
 8

---



---

bus. pk. gal. qt.  
 392 3 1 2  
 9

---



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## TIME.

years. da. ho. mi.  
 412 319 15 41  $\times$  24  
 $6 \times 4 = 24$

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4

days. ho. mi. sec.  
 197 16 52 48  $\times$  64  
 $8 \times 8 = 64$

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8

## DIVISION OF WEIGHTS AND MEASURES.

## TROY WEIGHT.

lbs. oz. dwt. gr.  
 2 ) 418 10 16 21

---

*Ans.*

2

*Prf.*

lbs. oz. dwt. gr.  
 3 ) 500 0 10 21

---

*Ans.*

3

*Prf.*

## AVOIRDUPOIS WEIGHT.

cwt. qr. lb. oz.  
4 ) 716 2 17 12

---



---

qrs. lb. oz. dr.  
5 ) 411 16 14 13

---



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## APOTHECARIES' WEIGHT.

lbs. oz. dr. scr.  
6 ) 600 8 7 2

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---

lbs. oz. dr. scr.  
7 ) 119 4 2 1

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## CLOTH MEASURE.

yds. qrs. na. in.  
8 ) 728 3 2 0

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Fr. ells. qr. na. in.  
9 ) 316 2 1 0

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## ALE AND BEER MEASURE.

kild. gal. qt. pt.  
10 ) 767 14 2 1

---



---

butts. hhd. gal. pt.  
11 ) 333 1 31 3

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## WINE MEASURE.

pipes. gal. qt. pt.  
12 ) 345 100 3 1

---



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hhd. gal. qt. pt.  
13 ) 354 47 0 1

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## LONG MEASURE.

miles. fur. po. yd.  
8 ) 611 3 3 2

---



---

fur. po. yd. ft.  
9 ) 115 10 3 2

---



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years. da. ho. mi.      days. ho. mi. sec.  
Divide 728 10 15 29 by 56.      Divide 619 19 52 50 by 144.\*  
8 × 7 = 56 for the divisors.      12 × 12 = 144 for the divisors.

\* Let these be divided by *Long Division* also.

A merchant in London bought of a farmer in Kent, 7 bags of hops:—No. 1 weighed 3 cwt. 2 qr. 14 lb.; No. 2, 3 cwt. 1 qr. 12 lb.; No. 3, 2 cwt. 3 qr. 15 lb.; No. 4, 4 cwt. 1 qr. 11½ lb.; No. 5, 5 cwt. 15 lb.; No. 6, 3 qr. 17½ lb.; and No. 7, 3 cwt. 1 qr. 11 lb.; the merchant, by agreement, was to pay the carriage to town; how many hundred weight had he to pay for?

*Ans.* 23 cwt. 2 qr. 12 lb.

A farmer grew upon his land, 217 qr. 3 bus. of wheat; 219 qr. 5 bus. 3 pk. of barley; 277 qr. 3 bus. of one sort of oats, and 249 qr. of another sort, besides 219 qr. 3 pk. of beans; 57 qr. 4 bus. of peas; and 57 qr. of vetches; how many quarters of corn, &c., did he grow in all?

*Ans.* 1297 qrs. 0 bus. 2 pk.

What is the total weight of 36 lb. 7 oz. 3 dr. 1 sc. 6 gr.; 14 lb. 6 oz. 3 dr. 1 sc. 17 gr.; 16 lb. 7 oz. 4 dr. 2 sc. 7 gr.; 13 lb. 6 oz. 3 dr. 9 gr.; 41 lb. 5 oz. 6 dr. 1 sc. 18 gr.; and twice 10 lb. 18 gr.?

*Ans.* 142 lbs. 9 oz. 6 dr. 0 sc. 13 gr.

A young man married when he was 23 yrs. 3 wk. 6 da. of age, and at the time of his marriage, his father was 57 yrs. 9 mo. 2 wk. 1 da. old; how old was the father when his son was born?

*Ans.* 34 yrs. 8 mo. 2 wk. 2 da.

A draper has sold 12 yds. 2 qr. 2 na. from a piece of Irish linen, which at first measured 28½ yds.; what quantity has he left?

*Ans.* 15 yds. 3 qr. 2 na.

A grocer had in his warehouse 16 cwt. 1 qr. 9 lb. of sugar; 17 cwt. 3 qr. 14 lb. of soap; 12 cwt. of tea; and 14 cwt. 3 qr. 14 lb. of raisins. He dealt out to one customer 4 cwt. 2 qr. 14 lb., to another 6 cwt. 3 qr. 14 lb., and lastly, he sold 3 cwt. 1 qr. 15 lb.; what weight of goods had he by him?

*Ans.* 46 cwt. 0 qr. 22 lb.

Suppose a silver punch bowl weigh 2 lb. 9 oz. 11 dwt.; what will 26 such bowls weigh?

*Ans.* 72 lb. 8 oz. 6 dwt.

If a ship sail 12 mi. 3 fur. 4 yds. in a day; what distance would she reach in a year?

*Ans.* 4517 mi. 5 fur. 25 po. 2½ yd.

Divide 1526 yds. 2 qr. 1 na. of cloth into 24 equal lengths.

*Ans.* 63 yds. 2 qr. 1 na.

If the divisor be 47, and the dividend 9469 pipes 2 hhd. 2 gal. 2 pt. of Madeira; what would be the quotient?

*Ans.* 201 pipes 0 hhd. 61 gal. 5 pt.  $\frac{4}{7}$ .

What is the weight of 4 doz. teaspoons, if each spoon weigh 17 dwt. 17 gr.?

*Ans.* 3 lb. 6 oz. 10 dwt.

A wine merchant compounded 2 tuns 3 hhd. 41 gal. of raisin wine with 2 hhd. 29 gal. of French brandy; when he has sold 1 tun 2 hhd. 61 gal. of it, how much will remain?

*Ans.* 1 tun 3 hhd. 9 gal.

Add 196 hhd. 46 gal. 2 qt., to 124 hhd. 19 gal. 3 qt.; then deduct 6 hhd. 18 gal. 1 qt. from the whole quantity, and divide the difference into 365 equal parts.

*Ans.*  $54 \frac{130}{365}$ , or  $54 \frac{26}{73}$  gal.

## REDUCTION.\*

REDUCTION points out the way of bringing numbers from one name to another, without altering their value.†

How many halfpence are there in 20 guineas?

Guineas.

20

21

20

40

420

12

5040

2

*Ans.* 10080 halfpence = to 20 Guineas.

\* It is necessary to understand this rule, both in Money and in Weights and Measures, as a leading introduction to the Rule of Three.

† All *great* names are brought into *small*, by MULTIPLYING with so many

How many guineas are equal in value to 10080 halfpence?

$$\begin{array}{r}
 2 \ ) \ 10080 \\
 \hline
 12 \ ) \ 5040 \\
 \hline
 21 \ \left\{ \begin{array}{l} 7 \ ) \ 420 \\ \hline 3 \ ) \ 60 \\ \hline \end{array} \right.
 \end{array}$$

*Ans.* 20 Guineas = to 10080 halfpence.

Bring £42 15s. 6½d. to farthings. *Ans.* 41065.

What number of halfpence are in £426 10s.?

*Ans.* 204720.

In £526 17s. 6d. how many shillings and sixpences?

*Ans.* 10537 sh. 21075 sixp.

In £200 14s. 3d. how many threepences?

*Ans.* 16057.

Change £179 11s. 6d. into twopences. *Ans.* 21549.

What number of crowns, shillings, groats, and pence, are in £526?

*Ans.* 2104 cr. 10520 sh. 31560 gr. 126240d.

How many guineas are equivalent to two thousand pounds?

*Ans.* 1904—16s. over.

How many half-guineas are there in £500?

*Ans.* 952—4s. over.

In £569 18s. 4d. how many groats and halfpence?

*Ans.* 34195 gr. 273560 halfp.

What number of crowns and shillings are there in £328 10s.?

*Ans.* 1314 cr. 6570 sh.

In 1200 groats, how many crowns, half-crowns, and sixpences?

*Ans.* 80 cr. 160 half-cr. 800 sixp.

of the less, as make one of the greater; and all *small* names are brought into *great*, by DIVIDING with so many of the less, as make one of the greater. The first two examples being solved, will explain this observation the more easily.

Change 142 pieces of silver, each valued at 45s. 6d., into threepences and pence. *Ans.* 25844 thr. 77532d.

Find how many groats are in 816 moidores, each 27s. *Ans.* 66096.

Bring 26420 pieces of coin, each 6s. 3d., into groats. *Ans.* 495375.

In 100000 dollars, each 4s. 9d., how many half-pence? *Ans.* 11400000.

Reduce 14280 pence to half-crowns, crowns, and pounds. *Ans.* 476 half-cr. 238 cr. £59—10s. over.

Bring 174200 groats, to crowns and pounds. *Ans.* 11613 cr.—20d. over; £2903—5s. over.

What number of sovereigns are in 24600 threepences, and the same number of sixpences? *Ans.* 922—10s. over.

In 426500 French crowns, each valued at 4s. 3d., how many guineas? *Ans.* 86315—10s. over.

How many half-guineas are there in a million of groats? *Ans.* 31746—1 gr. over.

Bring 82542 sixpences to guineas, and then to pounds. *Ans.* 1965 gui.—6s. over; £2063—11s. over.

In 10864 farthings, how many crowns, half-crowns, sixpences, and pence, and of each an equal number? *Ans.* 28 of each.

In 842 crowns, how many guineas? *Ans.* 200—10s. over.

## TROY WEIGHT.

In 120 lb. of silver, how many grains? *Ans.* 691200.

In 6 silver tankards, each weighing 16 oz. 4 dwt. 12 gr., how many grains? *Ans.* 46728.

Bring 82000 grains to pounds, and back to grains. *Ans.* 14 lb. 2 oz. 16 dwt. 16 gr.

If a pair of silver candlesticks weigh 3 lbs. 5 oz. 15 dwt., how many pennyweights in all? *Ans.* 835.

How many table-spoons, each weighing 3 oz. 5 dwt., can be made out of 19 oz. 3 dwt. 14 gr. of silver?

*Ans.*  $5 \frac{1438}{1000} = 5 \frac{719}{500}$ .

Required the weight of gold to make 7 watch cases, each weighing 1 oz. 18 gr., and 9 others of 1 oz. 10 dwt. each.

*Ans.* 1 lb. 8 oz. 15 dwt. 6 gr.

In 9120 grains of silver, how many tea-spoons, each half an ounce?

*Ans.* 38.

What is the weight of  $6\frac{3}{4}$  dozen of spoons, each weighing 1 ounce and a half?

*Ans.* 10 lb. 1 oz. 10 dwt.

### AVOIRDUPOIS WEIGHT.

In 4180405 ounces of butter, how many hundred weight?

*Ans.* 2332 cwt. 3 qr. 7 lb. 5 oz.

If 10 Gloucester cheeses weigh 3 qr.  $11\frac{1}{2}$  lb., what number of ounces are there?

*Ans.* 1528.

How many ounces and drams are in 5248 lb. of snuff?

*Ans.* 83968 oz. 1343488 dr.

In 10 chests of tea, each weighing 1 cwt. 3 qr. 16 lb., how many lbs.?

*Ans.* 2120.

How many samples of butter, each weighing  $2\frac{1}{2}$  lb., can be made out of 3 firkins, each 56 lb.?

*Ans.*  $67 - \frac{1}{2}$  lb. over.

In 30 tons 18 cwt. 2 qr. 10 lb. 12 oz. 15 dr., how many drams?

*Ans.* 17736399.

In 510 parcels of sugar, each  $18\frac{1}{4}$  lb., how many hundred weight?

*Ans.* 83 cwt. 11 lb. 8 oz.

How many boxes of raisins, each 24 lb. 8 oz., can be filled out of 3 tons 17 cwt.?

*Ans.* 352.

The middle arch of Southwark iron bridge weighed 1523 tons, how many half ounces is that?

*Ans.* 109168640.



How many gallons of train oil, each gallon weighing  $7\frac{1}{2}$  lb., are there in 14 cwt. 2 qr.? *Ans.* 216—4 lb. over.

What is the weight of 18 sacks of potatoes, weighing 186 lb. each? *Ans.* 29 cwt. 3 qr. 16 lb.

### APOTHECARIES' WEIGHT.

In 21 lb. 5 oz. 4 dr. 2 scr. 18 gr., how many grains? *Ans.* 123658.

Suppose an apothecary wishes to make 2 lb. 1 oz. of medicine into doses of 1 sc. 18 gr. each, how many would there be? *Ans.*  $315\frac{3}{8}$ .

Reduce 180045 scruples to pounds.

*Ans.* 625 lb. 1 oz. 7 dr.

Required the difference in grains between 7 parcels, each weighing 4 lb. 7 oz. 3 dr., and 2 dozen of 11 oz. 6 dr. 2 sc. each. *Ans.* 49740.

In 300 lb. 8 oz. of rhubarb, how many doses of 2 dr. each? *Ans.* 14432.

How many packages of 10 oz. are there in 56 lb. of bark? *Ans.*  $67\frac{1}{2}$ .

### CLOTH MEASURE.

In  $325\frac{1}{2}$  yards of cloth, how many nails? *Ans.* 5208.

Bring 252 English ells to yards. *Ans.* 315.

In 64 pieces of Irish linen, each  $24\frac{1}{2}$  yards, how many nails? *Ans.* 25088.

In 25 pieces of cloth, each 21 English ells, how many yards? *Ans.*  $656\frac{1}{2}$ .

In 27 bales, each of 14 pieces, and each piece  $21\frac{1}{2}$  yards, how many Flemish ells? *Ans.* 10836.

How many suits of clothes can be made from a piece of cloth measuring  $25\frac{1}{2}$  yards, reckoning a coat at  $1\frac{1}{4}$  yd., trousers at 1 yard 3 na., and waistcoat at half a yard? *Ans.* 7.

In a piece of linen, measuring 21 English ells, how many shirts can be cut of  $3\frac{1}{2}$  yds. each? *Ans.* 7.

## LONG MEASURE.

How many yards are there in 596 miles?

*Ans.* 1048960.

In 427692 feet, how many miles? *Ans.* 81 mi. 4 yd.

In 422 leagues, how many barley-corns?

*Ans.* 240641280.

How many barley-corns would reach round the world, which is equal to 360 degrees, each degree  $69\frac{1}{4}$  miles?

*Ans.* 4755801600.

In walking 16 miles, how many times does a stick touch the ground, supposing it to do so at every third step, each step being 2 ft. 6 in.?

*Ans.* 11264.

How many farthings would extend from the earth to the sun, which is reckoned at 95 millions of miles distant, supposing 7 farthings equal to 6 inches?

*Ans.* 7022400000000.

How many times will a wheel of 8 feet in circumference turn in a mile?

*Ans.* 660.

From Dublin to Liverpool is 38 leagues; how many boats, each 21 feet in length, would be required to form a line between the two places?

*Ans.*  $28662\frac{2}{7}$ .

## LAND MEASURE.

In 648 acres, how many perches? *Ans.* 103680.

In 17000 poles, how many yards? *Ans.* 514250.

In 19680 poles or perches, how many acres?

*Ans.* 123.

How many gardens of 16 po. 4 yd. each, can be made from a field of 8 acres?

*Ans.* 79.

In 674 ac. 6 po. how many yards? *Ans.*  $3262341\frac{1}{2}$ .

## ALE AND BEER MEASURE.

How many pints of porter will 264 hogsheads produce?

*Ans.* 114048.

Bring 2001 barrels of ale to half-pints?

*Ans.* 1152576.

In 15620 kilderkins, how many quarts?

*Ans.* 1124640.

In 476 butts of beer, how many hogsheads and barrels?

*Ans.* 952 hhds. 1428 bar.

In 10 casks of beer, each containing  $19\frac{1}{2}$  gallons, how many quarts and pints?

*Ans.* 780 qts. 1560 pt.

What number of kilderkins are there in 843 butts?

*Ans.* 5058.

How many firkins, of 9 gallons each, can be filled out of 1 butt, 1 hhd. and 1 barrel of beer?

*Ans.* 22.

At 2 quarts of ale at dinner, and three pints at supper daily, how many days will a butt last a family?

*Ans.* 123.

## WINE MEASURE.

In 136 pipes of port wine, how many pints?

*Ans.* 137088.

Bring 1300 tuns of Madeira into gallons.

*Ans.* 327600.

How many  $1\frac{3}{4}$  pint bottles can be filled from a hhd. of brandy?

*Ans.* 288.

In 12096 pints, how many puncheons?

*Ans.* 44 pun. 16 gal.

In 4 tuns, 3 hhd. 51 gal., how many pints?

*Ans.* 9984.

A pipe of port wine is to be drawn off into an equal number of quart, pint, and half-pint bottles; required the number of each?

*Ans.* 288.

In 74260 gallons of Cape wine, how many pipes, hogsheads, and tierces, and of each a like number?

*Ans.* 321 of each, and 109 gal. over.

A gentleman ordered his butler to bottle off a pipe of wine, that contained 126 gallons, into quarts and pints,

and to have an equal number of each ; I demand how many dozen he had ? *Ans.* 28 doz. of each.

### DRY MEASURE.

In 42620 quarters of wheat, how many pints ?

*Ans.* 21821440.

Bring 26408 gallons of oatmeal into quarters ?

*Ans.* 412 qrs. 5 bus.

How many quarters of corn are in half a million of quarts ?

*Ans.* 1953 qr. 1 bus.

In 42 qr. 2 bus. of wheat, 3 qr. 2 bus. of rye, and 5 qr. 7 bus. 2 pk. of oats, how many pecks ?

*Ans.* 1646.

How many horses would 7 lasts of oats feed, allowing half a peck to each ?

*Ans.* 4480.

In 194 tons of coals, how many lbs. ?

*Ans.* 434560.

How long will 10 tons of coals suffice for 3 fires, of which each burns 20 lb. daily ?

*Ans.* 373½ days.

### TIME.

In 1504260 minutes, how many days and weeks ?

*Ans.* 1044 days, 15 ho. ; 149 wk. 1 da.

How many minutes are there in 142 weeks ?

*Ans.* 1431360.

From January 1st to December 31st (each day inclusive), how many days ?

*Ans.* 365.

Bring 25 mo. 2 wk. 3 da. 19 ho., into hours and minutes.

*Ans.* 17227 ho. 1033620 mi.

How many times does a clock strike in 4 years ?

*Ans.* 227916.

From the birth of our Saviour to the end of the year 1837, how many seconds ?

*Ans.* 57971311200.

When a boy is 12 years old, how many hours has he lived in the world ?

*Ans.* 105192.

How many seconds are there in a solar year, which consists of 365 days, 5 ho. 48 mi. 57 sec. ?

*Ans.* 31556937.

## SIMPLE PROPORTION, OR THE RULE OF THREE.

THE RULE OF THREE teaches, from three numbers or terms given, to find a fourth, which shall bear such proportion to the third, as the second does to the first.\*

If 3 yards of flannel cost 2s. 7½d., what will 28 yards cost?

*Ans.* £1 4s. 6d.

yds.	s.	d.	yds.	Or, If	yds.	yds.	s.	d.
If 3 :	2	7½	:: 28	If 3 :	28	::	2	7½†
	12				126		12	
	31				168		31	
	4				336		4	
	126				3 ) 3528		126	
	28							
	1008				4 ) 1176			
	252				12 ) 294			
3 ) 3528					2,0 ) 2,4—6			
4 ) 1176					<i>Ans.</i> £1 4s. 6d.			
12 ) 294								
2,0 ) 2,4—6								
<i>Ans.</i> £1 4s. 6d.								

\* Let the first and third terms agree in name, and bring the middle term (if a mixed or compound number) to the lowest name or denomination mentioned; then multiply the second and third terms together, and divide their product by the first term, and the quotient will be the answer in the same name as the second term is, or may be reduced to, which may be multiplied or divided, as the case may be, according to the rules of Reduction.

† Some authors recommend another method of stating the question in reference to the following rule :—Put in the *third* place that term which is of the same kind as the answer. If, according to the nature and reason of the question, the answer is to be greater than the third term, place

If  $6\frac{1}{2}$  yards of cloth cost 17s.  $3\frac{1}{4}$ d., what cost 40 yards?

*Ans.* £5 6s.  $3\frac{1}{4}$ d.  $\frac{7}{8}$ .

What will a hundred weight of cheese come to, if 2 lb. cost 1s.  $6\frac{1}{2}$ d.?

*Ans.* £4 6s. 4d.

If a gallon of porter cost 2s. 8d., what will half a barrel come to?

*Ans.* £2 8s.

If a barrel of beer cost £2 10s., what will a butt cost?

*Ans.* £7 10s.

What will 12000 quills come to, at  $8\frac{1}{2}$ d. for 60?

*Ans.* £7 1s. 8d.

At  $10\frac{1}{2}$ d. per lb., what is the price of 7 cheeses, each weighing 26 lb. 10 oz.?

*Ans.* £8 3s.  $0\frac{1}{4}$ d.  $\frac{1}{8}$  or  $\frac{1}{4}$ .

If  $1\frac{1}{4}$  oz. of tea cost  $6\frac{3}{4}$ d., what will 24 lb. cost?

*Ans.* £8 12s.  $9\frac{1}{4}$ d.  $\frac{3}{4}$ .

If 24 lb. of tea cost £8 12s.  $9\frac{1}{4}$ d.  $\frac{3}{4}$ , what will  $1\frac{1}{4}$  oz. cost?

*Ans.*  $6\frac{3}{4}$ d.

Suppose 3 pieces of cloth, each  $30\frac{1}{2}$  yards, cost £21 7s.; what will  $\frac{3}{4}$  of a yard cost?

*Ans.* 3s. 6d.

I gave  $1\frac{1}{2}$ d. for  $1\frac{1}{2}$  lb. of potatoes, what would 2 tons weight cost?

*Ans.* £18 13s. 4d.

If a ton of iron cost £23 6s. 8d., what will  $2\frac{1}{2}$  lb. cost?

*Ans.*  $6\frac{1}{4}$ d.

How much will 3 nails of cloth come to, at 4s. 7d. for 2 yds. 3 qr.?

*Ans.*  $3\frac{3}{4}$ d.

What is wine a bottle, holding 3 half-pints, at £50 per pipe?

*Ans.* 1s.  $5\frac{3}{4}$ d.

What quantity of thread can I buy for 50s. 6d. when 3 lb. cost 8s. 4d.?

*Ans.* 18 lb. 2 oz.  $\frac{2}{10}\frac{2}{10}$ .

the greatest of the remaining terms in the *second* place. If the answer is to be less than the third term, put the least term in the *second* place; put the remaining term in the *first* place; multiply the second and third terms together, and divide by the first. It may be proper to observe, that it will often be necessary to reduce the terms to their lowest name, then the first of course must also be reduced to, or be of the same name as the second.

If  $3\frac{1}{2}$  lb. of green tea cost 28s. 6d., what will half a hundred weight come to? *Ans.* £22 16s.

How much is due to a person for 196 days' service, at a salary of £40 a year? *Ans.* £21 9s. 7d.  $\frac{3}{8}\frac{2}{5}$ .

If I lay by  $4\frac{1}{4}$ d. a week, what shall I have in 19 weeks, 4 days? *Ans.* 7s.  $8\frac{1}{4}$ d.  $\frac{1}{5}$ .

Suppose I receive 11s. 6d. in the pound, for a debt of £59 16s. 9d., what will be the dividend? *Ans.* £34 8s.  $1\frac{1}{2}$ d.  $\frac{1}{10}$ .

What will a maid servant's wages amount to in  $4\frac{1}{2}$  months if she be hired at 10 guineas a year? *Ans.* £3 18s. 9d.

Bought 3 lb. 5 oz. 15 dwt. of silver plate for £11 9s.  $7\frac{1}{2}$ d., what did I give per ounce? *Ans.* 5s. 6d.

How many pounds of sugar at  $9\frac{1}{2}$ d. per lb. are equal in value to 24 lbs. of tea at 9s. 6d. per lb.? *Ans.* 288.

What must I pay my brewer for  $3\frac{1}{2}$  barrels of ale, at £5 10s. per hhd.? *Ans.* £12 16s. 8d.

How many yards of cloth can I purchase for £402 5s. if 6 yards cost 28s. 8d.? *Ans.* 1683 yds. 3 qrs. 1 na.

How much in the pound does an insolvent pay, whose effects amount to £827 14s. and his debts to £2136? *Ans.* 7s. 9d.

A tradesman compounded with his creditors for paying 6s. 3d. in the pound, what was lost on a debt of £7964? *Ans.* £5475 5s.

Borrowed of a friend £200 for 10 months, how long ought I to lend him £95 to requite his kindness? *Ans.* 21  $\frac{1}{5}$  mo.

If a gentleman spend 19s. 6d. a day, and lay by £150 at the year's end, what is his yearly income? *Ans.* £505 17s. 6d.

How much may a person spend in 73 days, if he wishes to save every year 50 guineas out of an income of £650? *Ans.* £119 10s.

If a person be taxed £37 0s. 10d. at 7d. in the pound, what is the rental? *Ans.* £1270.

If a firkin of butter cost 38s., what will 14½ lb. come to? *Ans.* 9s. 10d.  $\frac{1}{4}$ .

At 7s. 7½d. in the pound, what will be the composition of a debt of £430 8s. 4d? *Ans.* £165 11s. 2d.

What are 40 butts, 3 qts. of ale worth, at £5 10s. per hhd.? *Ans.* £440 1s. 6½d.  $\frac{7}{8}$ .

If an ounce of silver be valued at 5s. 6d., what would be the price of a silver tankard, weighing 1 lb. 10 oz. 10 dwt. 4 gr.? *Ans.* £6 3s. 9½d.  $\frac{9}{16}$ .

A grocer bought a hogshead of sugar, weighing gross 16 cwt. 1 qr. 10 lb., and was allowed for tare 102 lb. and draft 56 lb.; he gave £21 11s. 6d. for it; what was the cost per hundred weight? *Ans.* £1 8s. 10¾d.

If £28 15s. 6d. was paid abroad for a pipe of port wine, and £12 14s. 6d. for the freight of it to London, besides the queen's duty and other incidental charges, amounting to £49 15s. 7d.; what are 47 gallons of it worth? *Ans.* £34 0s. 11½d.  $\frac{9}{16}$ .

Estimate the purchase of 26 tubs of butter, each weighing 48½ lb. at 45s. 6d. per cwt., allowing tare 2 lb. per tub, and draft in the whole 20 lb. *Ans.* £24 3s. 0½d. ½.

Value 138 stone 5 lb. of beef, at 4s. 2d. per stone, and tell the whole cost, and how it should be sold per lb. to gain 5 guineas by the whole?

*Ans.* £28 17s. 7½d. value; and 7½d. per lb.

A tea dealer bought 5 chests of souchong, weighing 57 lb. 7½ oz. each, for £57 11s. 8½d.; what did it cost per half-ounce? *Ans.* 1½d.

What will a tax of £900 amount to at 2s. 6d. in the pound? *Ans.* £112 10s.

A farm consisting of 400 acres 2 ro. 20 po., is let at 2 guineas an acre; what is the yearly rent of that farm?

*Ans.* £841 6s. 3d.



If 14 men perform a piece of work in 6 days, working ten hours a day ; in what time will 24 men perform it?

*Ans.* 3 days, 5 hours.

If 72 men had provisions for 35 days, but after 5 days 18 were sent away ; how long will the provisions last the remaining 54 men ?

*Ans.* 40 days.

If a tailor can make a coat and waistcoat with  $3\frac{3}{4}$  yards of cloth, which is  $1\frac{1}{2}$  yd. broad ; how many yards will he require to make the same, when the breadth is only 3 qrs.

*Ans.*  $7\frac{1}{2}$  yards.

## COMPOUND PROPORTION.

IN the Rule of Thrée, or Simple Proportion, there were *three* terms given to find a fourth ; but if the question involve an *odd* number of terms above three, as *five* or *seven*, it can be resolved only by successive applications of the Rule of Three, that is, by *successive Proportions*.

If the wages of 4 men for 6 days be £4 4s., what will be the wages of 14 men for 35 days ?

Men.	Men.	£	s.
4	: 14 ::	4	4
		20	
or, 2	: 7	—	
		84	
		7	
		—	
	2 )	588	
		—	
	2,0 )	29,4	
		—	
		£14	14s.
		—	

Here £4 4s., the single term which corresponds to the answer, is placed in the third term ; then, as 14 men will receive *more* wages in 6 days than 4 men in the same time, the *greater* of these two like terms (4 men, 14 men), viz., 14 men, is placed in the *second* term. The result of this operation gives £14 14s. as the wages of 14 men for 6 days. We have next to inquire what will be the wages of these 14 men for 35 days. Hence, by simple Proportion :—

Days.	Days.	£	s.
6	:: 35	:: 14	14
		20	
		294	
		35	
		1470	
		882	
		6 ) 10290	
		2,0 ) 171,5	
		£85 15s. <i>Ans.</i>	

Now it will conduce to simplicity of operation if these two statements be combined in the following manner, and the operation will be still further simplified, if any two numbers in the first and second terms can be divided by the same divisor, and the quotients used instead of the original numbers. Thus:—

<table style="width: 100%;"> <tr> <td style="text-align: right;">4 men : 14 men</td> <td style="text-align: right;">£ s.</td> </tr> <tr> <td style="text-align: right;">or, 2 men : 7 men :: 4</td> <td style="text-align: right;">4</td> </tr> <tr> <td></td> <td style="text-align: right;">20</td> </tr> <tr> <td style="text-align: right;">6 days : 35 days</td> <td style="text-align: right;">—</td> </tr> <tr> <td style="text-align: right;">12</td> <td style="text-align: right;">245</td> </tr> <tr> <td></td> <td style="text-align: right;">84</td> </tr> <tr> <td></td> <td style="text-align: right;">980</td> </tr> <tr> <td></td> <td style="text-align: right;">1960</td> </tr> <tr> <td style="text-align: right;">12 ) 20580</td> <td></td> </tr> <tr> <td style="text-align: right;">2,0 ) 171,5</td> <td></td> </tr> <tr> <td></td> <td style="text-align: right;">£85 15s.</td> </tr> </table>	4 men : 14 men	£ s.	or, 2 men : 7 men :: 4	4		20	6 days : 35 days	—	12	245		84		980		1960	12 ) 20580		2,0 ) 171,5			£85 15s.	<table style="width: 100%;"> <tr> <td style="text-align: right;">Or, 6 days : 35 days</td> <td style="text-align: right;">£ s.</td> </tr> <tr> <td style="text-align: right;">2) 4 men : 2) 14 men</td> <td style="text-align: right;">4 4</td> </tr> <tr> <td></td> <td style="text-align: right;">20</td> </tr> <tr> <td style="text-align: right;">2</td> <td style="text-align: right;">7</td> </tr> <tr> <td style="text-align: right;">6</td> <td style="text-align: right;">35</td> </tr> <tr> <td></td> <td style="text-align: right;">420</td> </tr> <tr> <td style="text-align: right;">12</td> <td style="text-align: right;">245</td> </tr> <tr> <td></td> <td style="text-align: right;">336</td> </tr> <tr> <td></td> <td style="text-align: right;">168</td> </tr> <tr> <td style="text-align: right;">12 ) 20580</td> <td></td> </tr> <tr> <td style="text-align: right;">2,0 ) 171,5</td> <td></td> </tr> <tr> <td></td> <td style="text-align: right;">£85 15s.</td> </tr> </table>	Or, 6 days : 35 days	£ s.	2) 4 men : 2) 14 men	4 4		20	2	7	6	35		420	12	245		336		168	12 ) 20580		2,0 ) 171,5			£85 15s.
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Or thus:—

If 4 men receive 4 guineas for 6 days.

1 man will receive 1 guinea for 6 days,

∴ 14 men will receive 14 guineas for 6 days;

hence, 6 days : 35 days :: 14 guineas : £85 15s. *Ans.*

If £11 14s. pay 12 labourers for 18 days, how many labourers will £70 4s. pay for 48 days?

The single term, 12 labourers, will be the third term of the stating; now if £11 14s. pay 12 labourers for 18 days, £70 4s. will pay *more* labourers for the same time of 18 days; therefore £70 4s. will be the second term, and £11 14s. the first term of the *first* proportion. Again, if £70 4s. pay a certain number of labourers for 18 days, the same sum will pay *fewer* labourers for 48 days; hence, 18 days will be the *second* and 48 days the *first* term of the *second* proportion. Thus:—

£	s.	:	£	s.	::	
11	14		70	4		12 labourers.
20			20			
<hr/>						
234			1404			
6 ) 48 days : 6 ) 18 days.						
<hr/>						
8			3			
234			1404			
<hr/>						
1872			4212			
			12			
<hr/>						
1872 ) 50544 ( 27 labourers. <i>Ans.</i>						
			3744			
			<hr/>			
			13104			
			13104			
			<hr/>			

If 20 masons build a wall 50 feet long, 2 feet thick, and 8 feet high, in 12 days, in how many days will 60 masons build a similar wall 500 feet long, 3 feet thick, and 12 feet high?

Here 12 days will obviously be the *third* term; then 60 masons will do the work in *less* time than 20 masons; therefore the first proportion (or rather, *ratio*) is 60 : 20.

Again, it will require *more* time to build a wall 500 feet long than one of 50 feet; *more* time for 3 feet thick than for 2 feet; and *more* time for 12 feet in height than for 8 feet; hence the other proportions are 50 : 500; 2 : 3; and 8 : 12. We have thus given the reason for the following statement:—

As 60 masons :	20 masons,	or 3 :	1 :: 12 days.
50 ft. :	500 ft.	or 1 :	10
2 ft. :	3 ft.	or 2 :	3
8 ft. :	12 ft.	or 2 :	3

$$\text{Hence } \frac{12 \times 1 \times 10 \times 3 \times 3}{3 \times 1 \times 2 \times 2} = 6 \times 5 \times 3 = 30 \times 3 = 90 \text{ days.}$$

If 8s. 2d. worth of bread be consumed in 7 days, by a family consisting of 6 adults and 5 children, when the price of the quartern loaf is  $7\frac{1}{4}$ d.; how many of the adults along with three of the children will consume 12s. 9d. worth of bread in 15 days, when the price of the quartern loaf is  $8\frac{1}{2}$ d., supposing that 3 children consume per day as much as 2 adults?

First ascertain how many adults would consume per day as much as 5 children, supposing that 3 children consume as much as 2 adults. Thus:—

$$3 \text{ child.} : 5 \text{ child.} :: 2 \text{ adults} : \frac{2 \times 5}{3} = \frac{10}{3} = 3\frac{1}{3} \text{ adults;}$$

hence  $6 + 3\frac{1}{3} = 9\frac{1}{3}$  adults; then making  $9\frac{1}{3}$  adults the third term of the statement, and considering that 12s. 9d. or 153d. will sustain *more* adults than 8s. 2d. or 98d.; that the *longer* the time and the *dearer* the bread, the *fewer* adults are required; the proportions will stand as follow:—

98d. : 153d. ::  $9\frac{1}{2}$  adults.  
 15 days : 7 days.  
 $8\frac{1}{2}$ d. or 17 half-d. :  $7\frac{1}{2}$ d. or 15 half-d.

$$\text{Then } \frac{9\frac{1}{2} \times 153 \times 7 \times 15}{98 \times 15 \times 17} = \frac{1428 \times 7}{98 \times 17} = \frac{1428}{14 \times 17} = \frac{102}{17} = 6;$$

and as 3 children consume as much as 2 adults, we get  
 $6 - 2 = 4$  adults, the number required.

If 8 men cut 18 acres of grass in 4 days, how many acres will 6 men cut in 16 days? *Ans.* 54 acres.

If the wages of 8 men for 6 days be £3 10s.; how much will pay 64 men for 91 days' work?

*Ans.* £424 13s. 4d.

If 14 horses eat 56 bushels of oats in 16 days, how many might be kept on 120 bushels for 24 days?

*Ans.* 20 horses.

If 18 men can dig a trench 30 yards long in 24 days by working 8 hours a day, how many will dig a trench 60 yards long in 64 days, working 6 hours a day?

*Ans.* 18 men.

If 1050 soldiers consume 250 qrs. of corn in 6 months, how many will 960 qrs. serve for 8 months?

*Ans.* 3024 soldiers.

If 12s. 3d. be paid for the carriage of 14 stones for 140 miles, how much ought to be paid for the carriage of 36 stones for 160 miles?

*Ans.* £1 16s.

If a carrier receives £6 8s. for the carriage of 4 cwt. for 248 miles, how much ought he to receive for 8 cwt. 3 qrs. 14 lbs. for 62 miles?

*Ans.* £3 11s.

If 2 horses plough  $4\frac{1}{2}$  acres of land in 6 days, when they work 8 hours a day, how many acres will 16 horses plough in 156 days, when they work  $12\frac{1}{2}$  hours a day?

*Ans.* 1462 acres, 2 roods.

If 180 sappers, in 6 days of 10 hours each, can dig a trench 200 yards long, 3 wide, and 2 deep; how many sappers will be required to dig a trench 360 yards long, 4 wide, and 3 deep, in  $43\frac{1}{2}$  days, working 9 hours each day?

*Ans.* 100 sappers.

If the 8d. loaf weighs 48 oz. when wheat is at 54s. per quarter, what should be the price of wheat when the 6d. loaf weighs 32 oz. 8 dwt.?

*Ans.* £3.

If the wages of 25 men amount to £76 13s. 4d. in 16 days, how many men must work 24 days to receive £108 10s., the daily wages of the latter being one-half those of the former?

*Ans.* 45 men.

## PRACTICE.

PRACTICE is a short, easy, and ready method of finding the value of goods by taking *aliquot* or even parts,\* and is usually adopted by persons engaged in trade and business.

*When the price is less than a penny.†*

Value 4260 apples at  $\frac{1}{4}$ d. each? *Ans.* £4 8s. 9d.

$\frac{1}{4}$  of a penny ( $\frac{1}{4}$ ) 4260 at  $\frac{1}{4}$

12 ) 1065

2,0 ) 8,8—9

*Ans.* £4 8s. 9d.

What are 2460 pears worth, at  $\frac{1}{4}$ d. each?

*Ans.* £5 2s. 6d.

What are 3000 pens worth, at  $\frac{3}{4}$ d. each?

*Ans.* £9 7s. 6d.

\* An *aliquot part* of any number is such a part as being taken a certain number of times, will exactly make that number. See the Table following those of weights and measures.

† These definitions, it is presumed, will suffice. A few words of *explanation* on the part of the teacher, will obviate the necessity of writing or repeating long rules, and be less irksome to the young scholar.

*When the price is just an aliquot part of a shilling.*

Find the worth of 3000 tops, at 1d. each.

*Ans.* £12 10s.

1d. of a shilling ( $\frac{1}{12}$ ) 3000 at 1d.

2,0 ) 25,0

*Ans.* £12 10s.

What are 4260 kites worth, at  $1\frac{1}{2}$ d. each?

*Ans.* £26 12s. 6d.

What will 1648 cricket balls come to, at 3d. each?

*Ans.* £20 12s.

Value 3692 lb. of moist sugar, at 4d. per lb.

*Ans.* £61 10s. 8d.

What will 9294 cakes come to, at 6d. each?

*Ans.* £232 7s.

*When the price is not an aliquot part of a shilling.*

What are 4000 little story books worth, at  $1\frac{1}{4}$ d. each?

*Ans.* £29 3s. 4d.

$1\frac{1}{4}$ d. of a shilling ( $\frac{1}{8}$ ) 4000 at  $1\frac{1}{4}$ d.

$\frac{1}{4}$  of  $1\frac{1}{4}$ d. ( $\frac{1}{8}$ ) 500  
83 4

2,0 ) 58,3 4

*Ans.* £29 3s. 4d.

Tell the cost of 252 pints of ale, at  $2\frac{1}{2}$ d. per pint.

*Ans.* £2 12s. 6d.

If a yard of tape cost  $4\frac{1}{2}$ d., what will 3650 yards cost?

*Ans.* £68 8s. 9d.

If 1 pair of worked socks cost  $7\frac{1}{4}$ d., what will 300 pairs come to?

*Ans.* £9 1s. 3d.

What is the price of 1168 lb. of butter, at 10½d. per lb.?

*Ans.* £52 6s. 4d.

*When the price is any EVEN number of shillings under 20.*

What must be charged for 2465 ciphering books, at 2s. each?

*Ans.* £246 10s.

2465 at 2s.

1

---

*Ans.* £246 10s.

Find the cost of 762 pair of shoes, at 4s. per pair.

*Ans.* £152 8s.

What will 2760 lb. of green tea cost, at 8s. per lb.?

*Ans.* £1104.

Suppose a gentleman's hat cost 18s., what would 456 come to?

*Ans.* £410 8s.

*When the price is any ODD number of shillings under 20.*

What will 4260 lb. of currants come to, at 1s. per lb.?

*Ans.* £213.

4260 at 1s.

1

---

2,0 ) 426,0

---

*Ans.* £213

Value 276 pair of cotton hose, at 8s. a pair?

*Ans.* £41 8s.

If a silk handkerchief cost 5s., what cost 526?

*Ans.* £131 10s.

Tell the cost of 8264 waistcoats, at 11s. each?

*Ans.* £4545 4s.



*When the price is any number of shillings and pence.*

Find the value of 345 lb. of coffee, at 1s. 8d. per lb.

*Ans.* £28 15s.

1s. 8d. of a pound ( $\frac{1}{12}$ ) 345 at 1s. 8d.

*Ans.* £28 15s.

What come 458 quires of paper to, at 2s. 6d. per quire?

*Ans.* £57 5s.

What will 3624 bottles of wine cost, at 4s. a bottle?

*Ans.* £724 16s.

Tell the price of 2437 pair of shoes, at 6s. 8d. per pair.

*Ans.* £812 6s. 8d.

Find the price of 3026 men's hats, at 10s. 6d. each?

*Ans.* £1588 13s.

10s. of a pound ( $\frac{1}{2}$ ) 3026 at 10s. 6d.

6d. of 10s. ( $\frac{1}{16}$ ) 1513

75 13

*Ans.* £1588 13s.

What are 8246 yards of broad-cloth worth, at 11s. 3d. a yard?

*Ans.* £4638 7s. 6d.

Value 7090 yards of muslin, at 5s. 5d. a yard?

*Ans.* £1920 4s. 2d.

What are 2724 lb. of cocoa worth, at 2s. 9d. per lb.?

*Ans.* £374 11s.

What will 1325 stone of meat come to, at 5s. 7½d. per stone?

*Ans.* £372 13s. 1½d.

Value 1234 women's gowns, at 19s. 11½d. each.

*Ans.* £1232 14s. 3½d.

If 1 lady's shawl cost 11s. 10½d., what cost 7298?

*Ans.* £4325 11s. 8½d.

*When the price is pounds, shillings, and pence.*

What will 428 suits of clothes come to, at £7 10s. 6d. per suit?

*Ans.* £3220 14s.

s.                      £ s. d.                      s.   £ s. d.  
10 of a pound ( $\frac{1}{2}$ ) 428 at 7 10 6    Or, as 1 : 7 10 6 :: 428  
7                      *Ans.* £3220 14s.

2996  
6d. of 10s. ( $\frac{1}{20}$ ) 214  
10 14  

---

*Ans.* £3220 14s.

Or, 428  
7  $\frac{1}{2}$   

---

2996  
224 14  

---

*Ans.* £3220 14s.

Suppose a silver watch cost £3 15s. 6d., what would 5016 come to?

*Ans.* £18935 8s.

What would 4261 gold necklaces be worth, at £4 17s. 9d. each?

*Ans.* £20825 12s. 9d.

Value 2046 casks of oil, at £8 17s. 6d. per cask.

*Ans.* £18158 5s.

*When there is any odd weight or measure in the quantity.*

What do 4280 $\frac{1}{2}$  lb. of souchong tea come to, at 3s. 2d. per lb.?

*Ans.* £677 14s. 1 $\frac{1}{2}$ d.

2d. of a shilling ( $\frac{1}{2}$ ) 4280 $\frac{1}{2}$  at ( $\frac{1}{2}$ ) 3s. 2d.

3                      0s. 9 $\frac{1}{2}$ d.  
12840  
713 4  
9 $\frac{1}{2}$   

---

2,0 ) 1355,4 1 $\frac{1}{2}$   

---

*Ans.* £677 14s. 1 $\frac{1}{2}$ d.

Find the price of 519½ yards of calico, at 1s. 6½d. per yard.

*Ans.* £40 0s. 10½d.

What will 3561½ gallons of tent wine cost, at 12s. 6½d. per gallon?

*Ans.* £2233 10s. 3½d.

What is the value of 97 cwt. 15 lb. of tobacco, at £3 17s. 10d. per cwt.?

$$\begin{array}{r}
 \text{£} \quad \text{s.} \quad \text{d.} \\
 3 \quad 17 \quad 10 \times 1 \\
 \hline
 12 \\
 \hline
 46 \quad 14 \quad 0 \\
 \hline
 8 \\
 \hline
 373 \quad 12 \quad 0 \\
 3 \quad 17 \quad 10 \\
 14 \text{ lb. } \left( \frac{1}{8} \right) \quad 9 \quad 8\frac{1}{2} \\
 1 \text{ lb. } \left( \frac{1}{14} \right) \quad 0 \quad 8\frac{1}{2} \\
 \hline
 \text{Ans. } £378 \quad 0 \quad 3
 \end{array}$$

Or by Proportion:—

$$\begin{array}{rcl}
 \text{lb.} & \text{£ s. d.} & \text{cwt. qrs. lb.} \\
 \text{As } 112 & : 3 \quad 17 \quad 10 & :: 97 \quad 0 \quad 15 \\
 & \text{Ans. } £378 \quad 0\text{s.} \quad 3\text{d.}
 \end{array}$$

Or thus:—

$$\begin{array}{r}
 \text{cwt. lb.} \\
 97 \quad 15 \text{ at } 77 \quad 10 \\
 77 \quad 10 \\
 \hline
 679 \\
 679 \\
 6\text{d. } \left( \frac{1}{8} \right) \quad 48 \quad 6 \\
 4\text{d. } \left( \frac{1}{8} \right) \quad 32 \quad 4 \\
 \hline
 7549 \quad 10 \\
 14\text{lb. } \left( \frac{1}{8} \right) \quad 9 \quad 8\frac{1}{2} \\
 1\text{lb. } \left( \frac{1}{14} \right) \quad 0 \quad 8\frac{1}{2} \\
 \hline
 2,0 \quad 756,0 \quad 3
 \end{array}$$

*Ans.* £378 0s. 3d.

Or thus:—

$$\begin{array}{r}
 \text{£ s. d.} \\
 97\frac{15}{112} \text{ at } 3 \quad 17 \quad 10 \times 1 \\
 \hline
 12 \\
 \hline
 46 \quad 14 \quad 0 \\
 \hline
 8 \\
 \hline
 373 \quad 12 \quad 0 \\
 3 \quad 17 \quad 10 \\
 10 \quad 5 \\
 \hline
 \text{Ans. } £378 \quad 0 \quad 3
 \end{array}$$

What are 56 hhds. 2 firks. 6 gal. of Burton ale worth, at £4 11s. 8d. per hhd. ? *Ans.* £258 14s. 0½d.

Value 132 cwt. 0 qr. 16 lb. of tobacco, at £13 11s. 8d. per cwt. *Ans.* £1794 18s. 9½d.

If I pay £2 14s. 1½d. for 1 cwt. of coarse sugar, what will 146cwt. 3qr. 19½lb. come to? *Ans.* £397 12s. 1½d.

Bought 94 tuns 2 hhd. 15 gal. of port wine at £130 8s. 6d. per tun; required the full value.

*Ans.* £12332 18s. 6d.

What is the price of 128 tons\* of straw, at 2½ guineas a load? *Ans.* £504.

Find the value of 300 barrels of beer at 19d. a gallon. *Ans.* £855.

What must I pay for 12 hogsheads of beer, at 4½d. per quart? *Ans.* £48 12s.

Required the purchase of 78 firkins of butter, at 10½d. per lb., and 48 Gloucester cheeses, each weighing 7½lb., at 8d. per lb. *Ans.* £191 2s. for the butter, and £12 8s. for the cheese.

Bought 40 pieces of Russia sheeting, each containing 34½ yards, at 3s. 11½d. per yard; what did the whole cost? *Ans.* £273 2s. 6d.

Value 17½cwt. of sugar at 9½d. per lb. *Ans.* £79 12s. 6d.

What are 17 hhd. 14 gal. of wine worth, at 3s. 4½d. a pint? *Ans.* £1464 15s.

## TARE AND TRET.

TARE AND TRET is a rule which points out what deductions† are allowed, when goods are purchased in *wholesale* quantities.

\* A ton of straw is equal to a load and a half; consequently 128 tons will make 192 loads.

† *Tare* is an allowance to the buyer for the weight of the cask, chest, box, bag, &c. which contains the goods purchased.

*Gross* signifies the whole weight before any deductions are made.

*Draft* is a deduction for the turn of the scale, that the weight may hold

If the gross weight be 49 cwt. 1 qr. 10 lb., and the tare 3 cwt. 2 qr. 18 lb., what is the net weight?

*Ans.* 45 cwt. 2 qr. 20 lb.

cwt.	qr.	lb.
49	1	10 gross.
3	2	18 tare.

*Ans.* 45 2 20 net.

Suppose the gross weight to be 32 cwt. 2 qr. 14 lb., the tare 116 lb., and the draft 25 lb., how much is the net weight?

*Ans.* 31 cwt. 1 qr. 13 lb.

cwt.	qr.	lb.
32	2	14 gross.
1	0	4 = 116 tare.
31	2	10 suttie.
		25 draft.

*Ans.* 31 1 13 net.

Or in lbs., thus:—

cwt.	qr.	lb.
32	2	14
4		
<hr/>		
130		
28		
<hr/>		
1054		
260		
<hr/>		
3654		
116		
<hr/>		
3538		
25		
<hr/>		

*Ans.* 3513 lb. net.

Or so:—

32	} The <i>hundreds</i> to be considered as <i>lbs.</i> , and thus arranged.
32	
32	
32	
56 = 2 qr.	
14 lb.	
<hr/>	
3654	gross.
116	tare.
<hr/>	
3538	suttie.
25	draft.
<hr/>	
<i>Ans.</i> 3513	net wt.

good, or not be diminished, when the commodity comes to be sold in *retail* quantities.

*Net*, or *Net Weight*, is what remains when all allowances have been taken off.

*Tret* and *Cloff* (which are now pretty generally abolished) used to be an allowance of 4 lb. in every 104 lb. for the former, and 2 lb. in every 3 cwt. for the latter.

Bought 79 cwt. 20 lb. of tobacco, and was allowed for tare 245 lb., and for draft, 56 lb.; required the number of net lbs. *Ans.* 8567.

What is the net weight of 4 hogsheads of sugar, weighing gross, 68 cwt. 1 qr. 14 lb.; tare, 3 qr. 8 lb. per hhd.; and draft, 2 qr. 21 lb.? *Ans.* 64 cwt. 1 qr. 17 lb.

If the gross weight of 19 bags of goods be 12 cwt. 1 qr. 4 lb. each; tare, per bag, 15 lb.; and tret, 4 lb. in every 104 lb. allowed; what is the net weight?

*Ans.* 222 cwt. 0 qr. 1 lb.

What is the net weight of 6 bags of hops, each weighing 2 cwt. 1 qr. 4 lb.; tare, 28 lb. per cwt.; and tret, 4 lb. per 104 lb.?

*Ans.* 9 cwt. 3 qr. 16 lb.

What is the net weight of 9 frails of raisins, each weighing 3 cwt. 3 qr. 4 lb. gross; tare, 22 lb. per frail; and draft, 6 lb. per frail?

*Ans.* 31 cwt. 3 qr. 8 lb.

In 8 jars of oil, each 3 qr. 14 lb. gross; tare, per jar, 12 lb.; and draft 14 lb.; how many net gallons?\*

*Ans.* 89 $\frac{1}{4}$ .

What is the net weight and value of 17 hhds. of sugar, each weighing 17 cwt. 3 qr. 19 lb. gross; tare, 18 lb. per cwt.; and draft, 1 cwt. 3 qr. 10 lb.; at 97s. 6d. per cwt.?

*Ans.* Weight 253 cwt. 3 qr. 10 lb.; value £1237 9s. 3 $\frac{1}{2}$ d.

What is the net weight of 7 hhds. of tobacco, each being 5 cwt. 2 qr. 7 lb. gross; tare, 8 lb. per cwt.; tret, 4 lb. per 104 lb.; and cloff, 2 lb. on every 3 cwt.?

*Ans.* 34 cwt. 2 qr. 8 lb.

Bought 5 hhds. of tobacco weighing as under, viz.,—

	cwt.	qr.	lb.	
No. 1	5	3	17	
2	5	0	27	Tare of each hhd. 100 lb., draft
3	5	1	26	in the whole 36 $\frac{1}{2}$ lb.; what is the
4	5	3	27	net weight?
5	5	2	0	<i>Ans.</i> 23 cwt. 1 qr. 8 $\frac{1}{2}$ lb.

Sold 57 tubs of butter, each weighing 85 $\frac{1}{2}$  lb., tare

\* 7 $\frac{1}{2}$  lbs. of oil make a gallon.

19 lb. per tub; what is the net weight, and cost of the whole at  $10\frac{1}{2}$ d. per lb.?

*Ans.* Net weight 3790 lb. 8 oz.; value £165 16s.  $8\frac{1}{2}$ d.

Find the net weight and full value of the four following cases; namely,—

No.	1	weighing	cwt.	qr.	lb.	lb.	
	4	1	17	tare	145	draft	4 lb. per case,
2	3	3	21	141	tret	4 lb. per 104 lb.,	
3	4	0	6	143	at	3s. 9d. per lb.	
4	4	1	11	144			

*Ans.* 1237 lb.; value £231 18s. 9d.

### SIMPLE INTEREST.

**SIMPLE INTEREST** is to be understood as showing the money allowed by the borrower to the lender for the use of any fixed sum, lent for a certain space of time; which, according to law, must not exceed £5 per cent. per annum; and so on in the same proportionate value.

The *principal* is the money lent; the *rate* is the sum per cent. agreed on for the loan; and the *amount* is the principal and interest added together.\*

What is the interest of £149 12s. 6d. for one year, at £5 per cent.?

*Ans.* £7 9s.  $7\frac{1}{2}$ d.

£	s.	d.
149	12	6
		5
<hr/>		
7,48	2	6
	20	
<hr/>		
9,62		
	12	
<hr/>		
7,50		
	4	
<hr/>		
$\frac{1}{2}$	00	

\* If the principal be multiplied by the rate per cent., and divided by 100, it will give the interest for one year. The rate and years may be multiplied either successively or separately.

What is the interest of £500, for 2 years, at  $£4\frac{1}{2}$  per cent. per annum?

*Ans.* £45.

Or thus:—

$\frac{\text{£}}{\text{a.}}$	$\frac{\text{£}}{\text{a.}}$	$\frac{\text{£}}{\text{a.}}$
$\frac{1}{2} (\frac{1}{2})$	$10 (\frac{1}{2})$	22
500	500	10 for 1 year.
4	4	2
<hr/>	<hr/>	<hr/>
2000	2000	<i>Ans.</i> 45
250	250	0 for 2 years.
<hr/>	<hr/>	<hr/>
2250	22,50	
2	20	
<hr/>	<hr/>	
£45,00	10,00	
<hr/>	<hr/>	

What is the interest of £375 5s. for  $2\frac{1}{2}$  years, at  $£4\frac{1}{2}$  per cent.?

*Ans.* £44 11s.  $2\frac{1}{2}$ d.

Tell the amount of £40 10s. for 3 years, at  $3\frac{1}{2}$  per cent.

*Ans.* £44 15s.  $0\frac{1}{2}$ d.

What is the interest of £845 10s. for a quarter of a year, at 5 per cent.?

*Ans.* £10 11s.  $4\frac{1}{2}$ d.

What is the interest of 300 guineas for 6 yrs. 8 mo. 20 da.,\* at  $4\frac{1}{2}$  per cent.?

*Ans.* £95 5s. 9d.

What is the interest of £100 for 27 weeks, 3 days,† at £5 per cent.?

*Ans.* £2 12s. 7d.

Find the commission‡ on £345, at  $2\frac{1}{2}$  per cent.

*Ans.* £8 12s. 6d.

\* If there be months, weeks, and days, or fractional parts, they must be wrought by the aliquot parts of a year, and added to the rest of the work.

† To find the interest for days and weeks it is usual to work the sum by the Rule of Three; but another rule is, to multiply the sum or principal by the number of days, and divide the product by 365, for the interest in *shillings*; or by 7300 (that is,  $365 \times 20$ ), for the interest in *pounds*, which is the readiest way of ascertaining the amount of interest at £5 per cent. per annum. To calculate the interest for days, multiply the principal by the number of days, and by *double the rate* per cent. Add these products and divide the sum by 73000.

‡ *Commission*, as well as what is called *Brokerage*, is an allowance made to a person called a Broker, for disposing or selling of goods, &c., to the best advantage, whereby he himself derives a profit at a given rate per cent.



What is the amount of £362 12s. 9d. from July 7th to Nov. 28th following, at £5 per cent. per annum?

*Ans.* £369 15s. 9½d.

I demand the brokerage of £152 at 4s. 6d. per cent.?

*Ans.* 6s. 10d.

Tell the amount of £795 13s. 4d. at 3½ per cent., for 6 years.

*Ans.* £962 15s. 1½d.

What is the interest of £1000 10s. 6d. for twelve days at 5 per cent.?

*Ans.* £1 12s. 10½d.

How much must I pay a broker, at ¾ per cent., for £11250?

*Ans.* £42 3s. 9d.

At 5½ commission, what must I pay for goods sold to the amount of £327 15s. 4d.?

*Ans.* £16 18s. 8½d.

What is the value of £300 of the 3 per cent. stock at £81 per cent.?

*Ans.* £243.

Value £7000 East India stock, at 197½ per cent.

*Ans.* £13816 5s.

What is the purchase of £918 14s. Bank stock, at £127½ per cent.?

*Ans.* £1173 12s. 9½d.

If a factor be allowed 2½ per cent., what does his commission amount to on 1000 guineas?

*Ans.* £27 11s. 3d.

If a broker be allowed 5s. 6d. per cent., what will the brokerage amount to on £829 17s. 6d.?

*Ans.* £2 5s. 7½d.

What is the cost of £735 15s. in the 3 per cent. consols, at £78½ per cent.?

*Ans.* £574 16s. 1d.

What is the amount of £250 10s. 6d. for 40 days, at £3½ per cent.?

*Ans.* £251 9s. 8½d.

Find the interest of £351 from 5th March to 6th August at £4½ per cent.

*Ans.* £6 13s. 3½d.

What is the commission of £2000 at ¼ per cent.?

*Ans.* £5.

If I allow a broker ¾ per cent., what will his brokerage amount to on £2165 10s. 6d.

*Ans.* £13 10s. 8½d.

What is the insurance\* of £195 5s. at  $10\frac{1}{2}$  per cent.?

*Ans.* £20 10s. 0 $\frac{1}{4}$ d.  $\frac{1}{2}$ .

What is the purchase† of £710 South Sea stock, at 103 $\frac{1}{2}$  per cent.?

*Ans.* £735 14s. 9d.

My correspondent writes me word that he has bought goods on my account to the amount of £954 16s. 6d.; what does his commission come to at 50s., or  $2\frac{1}{2}$  per cent.?

*Ans.* £23 17s. 4 $\frac{1}{2}$ d.

If £100 stock cost £61 2s. 6d. money, what will £1000 stock cost?‡

*Ans.* £612 10s.

If £100 stock sell for £65 10s., what will £575 sell for?§

*Ans.* £375 18s.

## DISCOUNT.

DISCOUNT is the allowing a certain rate per cent. for the payment of money before it becomes due, consequent to what may be agreed on between the parties concerned.||

Find the interest and present value of £250 due 9 months hence, at 5 per cent.

£	mo.	£ s.	£ s. d.
250	$6=\frac{1}{2}$	12 10	250 0 0 debt.
5			9 7 6 discount.
<hr/>	$3=\frac{1}{2}$	6 5	<hr/>
12,50		3 2 6	240 12 6 present value.
20			<hr/>
<hr/>		£9 7 6	
10,00		<hr/>	

\* Insurance is a protection from damage and loss by fire, risk of ships at sea, &c., for which is paid a certain rate per cent.

† Purchasing of Stock is the purchasing and disposing of a certain sum of money in the Bank of England.

‡ Adding one-eighth per cent., or ten half-crowns, for brokerage.

§ Deducting 14s. 6d. for brokerage, which is never less than a shilling.

|| In the routine of business the usual way now in almost all mercantile and banking houses of calculating the discount of any note or bill is, to deduct the interest of the sum for the given time at 5 per cent.; or to reckon a penny a pound for every month the bill has to run.

## DISCOUNT.

Or thus, briefly :—

$$\begin{array}{r}
 \text{d.} \\
 250 \\
 9 \\
 \hline
 12 \ ) \ 2250 \\
 \hline
 2,0 \ ) \ 18,7-6 \\
 \hline
 \text{Ans. } \underline{\underline{\pounds 9 \ 7\text{s.} \ 6\text{d.}}} \text{ discount.}
 \end{array}$$

The following solution appertains to the old method of finding the discount, which in commercial practice has now become obsolete :—

$$\begin{array}{r}
 \pounds \quad \text{s.} \\
 6 \ (\frac{1}{2}) \ 5 \ 0 \\
 \hline
 3 \ (\frac{1}{2}) \ 2 \ 10 \\
 \quad \quad 1 \ 5 \\
 \hline
 \quad \quad 3 \ 15 \\
 \text{Add } 100 \ 0 \\
 \hline
 \underline{\underline{\pounds 103 \ 15}}
 \end{array}$$

$$\begin{array}{l}
 \pounds \quad \text{s.} \quad \pounds \quad \text{s.} \quad \pounds \quad \text{s.} \\
 \text{Then, As } 103 \ 15 : 3 \ 15 :: 250 \ 0 \\
 \text{Or, As } 103 \ 15 : 250 :: 3 \ 15
 \end{array}
 \left. \vphantom{\begin{array}{l} \pounds \quad \text{s.} \\ \pounds \quad \text{s.} \end{array}} \right\} : \pounds 9 \ 0\text{s.} \ 8\frac{1}{2}\text{d. discount.}$$

Lastly,  $\pounds 9 \ 0\text{s.} \ 8\frac{1}{2}\text{d.}$  taken from  $\pounds 250$  leaves  $\pounds 240 \ 10\text{s.} \ 3\frac{1}{2}\text{d.}$ , its present value.

Required the discount of  $\pounds 1000$  due 70 days hence, at 5 per cent. *Ans.*  $\pounds 9 \ 11\text{s.} \ 9\frac{1}{2}\text{d.}$

$$\begin{array}{r}
 \pounds \\
 1000 \\
 5 \\
 \hline
 \pounds 50,00
 \end{array}
 \qquad
 \begin{array}{r}
 \text{d.} \quad \pounds \quad \text{d.} \\
 \text{As } 365 : 50 :: 70
 \end{array}$$

Or thus,  $\pounds 50 \times 70 \div 365 = \pounds 9 \ 11\text{s.} \ 9\frac{1}{2}\text{d.}$

What is the discount on a bill of £150 which has 60 days to run, at 5 per cent.? *Ans.* £1 4s. 8d., nearly.

## COMPOUND INTEREST.

COMPOUND INTEREST may be defined interest upon interest, since it arises from adding the interest, as it becomes due, to the principal; but money cannot be lent after this manner, although it is allowed in granting or purchasing annuities, leases, or reversions.

What is the compound interest of £700 18s. for 2 years, at £5 per cent. per annum?

£	s.	£	s.	d.	
700	18	700	18	0	
	5	35	0	10½	
<hr/>		<hr/>			
35,04	10	735	18	10½	1st year's
20			5		amount.
<hr/>		<hr/>			
0,90		36,79	14	5½	
12		20			
<hr/>		<hr/>			
10,80		15,94			
4		12			
<hr/>		<hr/>			
£, 20		11,33			
<hr/>		<hr/>			
		4			
		<hr/>			
		1, 35			
		<hr/>			

£	s.	d.
735	18	10½
36	15	11½

772	14	10	2nd year's amount.
700	18	0	1st year's principal.

*Ans.* £71 16 10 interest for 2 years.

Or thus:—

	£	s.	d.	
$5 = \frac{1}{50}$	700	18	0	first year's principal.
	35	0	$10\frac{1}{2}$	interest (add).
<hr/>				
$5 = \frac{1}{50}$	735	18	$10\frac{1}{2}$	second year's principal.
	36	15	$11\frac{1}{2}$	interest (add).
<hr/>				
	772	14	10	amount.
	700	18	0	first year's principal.
<hr/>				
<i>Ans.</i>	£71	16	10	interest for two years.

What is the amount of £725 in  $2\frac{1}{2}$  years, at 5 per cent. per annum?

*Ans.* £819 5s.  $10\frac{1}{2}$ d.

What is the compound interest of £387 15s. for  $2\frac{1}{2}$  years, at 4 per cent. per annum; interest payable quarterly?

*Ans.* £35 16s. 8d.

What will be the compound interest of £650 for 4 years 9 months, at  $3\frac{1}{2}$  per cent. per annum?

*Ans.* £115 9s.  $4\frac{1}{2}$ d.

Find what 1000 guineas will amount to in 5 years, at £4 10s. per cent. per annum.

*Ans.* £1308 9s.  $9\frac{1}{2}$ d.

## GREATEST COMMON MEASURE.

ONE number is said to be a *measure* or *factor* of another, when the one divides the other without remainder; thus, 2, 3, 5, are all measures or factors of 30.

A common measure of two or more numbers is one which divides each of them without remainder; and the greatest common measure of two or more numbers is the greatest number which will so divide them; thus, 3, 4, 6, 12, 36, are all common measures of 72 and 108, and 36 is their greatest common measure.

Find the greatest common measure of 686 and 4165.

$$\begin{array}{r}
 686 \overline{) 4165} \text{ ( 6} \\
 \underline{4116} \\
 49 \overline{) 686} \text{ ( 14} \\
 \underline{49} \\
 196 \\
 \underline{196} \\
 0
 \end{array}$$

The greater number is divided by the less, and the less number 686 is then divided by the remainder 49, which is the greatest common measure of the two numbers in the question.

Find the greatest common measure of 6327 and 23997.

First method.

$$\begin{array}{r}
 6327 \overline{) 23997} \text{ ( 3} \\
 \underline{18981} \\
 5016 \overline{) 6327} \text{ ( 1} \\
 \underline{5016} \\
 1311 \overline{) 5016} \text{ ( 3} \\
 \underline{3933} \\
 1083 \overline{) 1311} \text{ ( 1} \\
 \underline{1083} \\
 228 \overline{) 1083} \text{ ( 4} \\
 \underline{912} \\
 171 \overline{) 228} \text{ ( 1} \\
 \underline{171} \\
 57 \overline{) 171} \text{ ( 3} \\
 \underline{171} \\
 0
 \end{array}$$

Second method.

$$\begin{array}{r}
 6327 \overline{) 23997} \text{ ( 4} \\
 \underline{25308} \\
 1311 \overline{) 6327} \text{ ( 5} \\
 \underline{6555} \\
 228 \overline{) 1311} \text{ ( 6} \\
 \underline{1368} \\
 1083 \overline{) 1311} \text{ ( 1} \\
 \underline{1083} \\
 228 \overline{) 1083} \text{ ( 4} \\
 \underline{912} \\
 171 \overline{) 228} \text{ ( 1} \\
 \underline{171} \\
 57 \overline{) 171} \text{ ( 3} \\
 \underline{171} \\
 0
 \end{array}$$

The greatest common measure is 57, and the second method is shorter than the first, because the *nearest* quotient figure is employed.

Find the greatest common measure of

612 and 828.	<i>Ans.</i> 36.
2520 and 3960.	<i>Ans.</i> 360.
315 and 1155.	<i>Ans.</i> 105.
360 and 708.	<i>Ans.</i> 12.
770 and 2431.	<i>Ans.</i> 11.
1785, 3255, and 7140.*	<i>Ans.</i> 105.

### LEAST COMMON MULTIPLE.

ONE number is said to contain, or to be a multiple of another, when it can be divided by it without remainder; thus, 12 is a multiple of 4.

A common multiple of two or more numbers is one which contains each of them, and the *least* number that can be divided by each of them without remainder is *their* least common multiple.

Find the least common multiple of 12 and 16; and also of 4, 6, 7, 8, 9:

$$\begin{array}{r}
 4 \overline{) 12} \quad 16 \\
 \underline{8} \quad 4 \\
 4 \\
 \underline{12} \\
 4 \\
 \underline{16}
 \end{array}$$

*Ans.* 48 = least common multiple.

$$\begin{array}{r}
 2 \overline{) 4, 6, 7, 8, 9} \\
 \underline{2} \quad 2, 3, 7, 4, 9 \\
 3 \overline{) 1, 3, 7, 2, 9} \\
 \underline{1} \quad 1, 7, 2, 3
 \end{array}$$

Then,  $2 \times 2 \times 3 \times 7 \times 2 \times 3 = 504$ . *Ans.*

Find the least common multiple of 5, 15, and 25.

*Ans.* 75.

\* When the greatest common measure of any two of these numbers is found, operate with this common measure and the remaining number as before, and the greatest common measure of the three numbers will be found.

Find the least common multiple of 8, 12, 15, and 20.

*Ans.* 120.

Find the least common multiple of 849 and 1132.

*Ans.* 3396.

## VULGAR FRACTIONS.

A FRACTION is any part or parts of something considered as a whole, and is expressed by two numbers placed one above the other, with a line between them, as  $\frac{1}{2}$ ,  $\frac{3}{4}$ ,  $\frac{5}{6}$ , &c.

The number above the line is called the *numerator*, and that below it the *denominator*. The first shows how many parts the fraction consists of, and the under figure, how many parts the quantity is divided into.\*

*To reduce a fraction to its lowest terms.*

Reduce  $\frac{36}{240}$  to its lowest terms.

$$\begin{array}{r} 36 \overline{) 240} \quad ( 6 \\ \underline{216} \end{array}$$

$$\begin{array}{r} 24 \overline{) 36} \quad ( 1 \\ \underline{24} \end{array}$$

$$\begin{array}{r} 12 \overline{) 24} \quad ( 2 \\ \underline{24} \end{array}$$

$$12 \overline{) \frac{36}{240}} = \frac{3}{20} \text{ Ans.}$$

Reduce  $\frac{111}{132}$  to its lowest terms.

*Ans.*  $\frac{37}{44}$ .

\* Fractions are either proper, improper, compound, or mixed.

The *proper* fraction is when the numerator is less than the denominator, as  $\frac{1}{2}$ ,  $\frac{3}{4}$ ,  $\frac{5}{6}$ , &c.

An *improper* fraction is when the numerator is equal to, or greater than, the denominator, as  $\frac{3}{2}$ ,  $\frac{5}{3}$ , &c.

A *compound* fraction is simply the fraction of a fraction, as  $\frac{1}{2}$  of  $\frac{3}{4}$  of  $\frac{5}{6}$ , &c.

A *mixed* number is that which is composed of a whole number and a fraction joined with it; as  $5\frac{1}{2}$ ,  $14\frac{3}{4}$ ,  $3\frac{5}{6}$ , &c.



Reduce  $\frac{3}{4}\frac{3}{4}$  to its lowest terms. *Ans.*  $\frac{1}{2}\frac{1}{2}$ .

Reduce  $\frac{5}{8}\frac{5}{8}$  to its lowest terms. *Ans.*  $\frac{3}{4}$ .

*To reduce a mixed number to an improper fraction.*

Reduce  $24\frac{5}{8}$  to an improper fraction.

$$\frac{24\frac{5}{8}}{8}$$

Or thus,  $24 \times 8 + 5 = 197$ . *Ans.*

$\frac{197}{8}$  *Ans.*

Reduce  $38\frac{1}{2}$  to an improper fraction. *Ans.*  $\frac{111}{2}$ .

Reduce  $64\frac{3}{4}$  to an improper fraction. *Ans.*  $\frac{519}{4}$ .

Reduce  $45\frac{1}{2}$  to an improper fraction. *Ans.*  $\frac{91}{2}$ .

*To reduce an improper fraction to its proper terms, or to its equivalent mixed number.*

Reduce  $\frac{84}{9}$  to its proper or whole terms.

$$\begin{array}{r} 9 \overline{) 84} \quad ( 9\frac{3}{9} \text{ } Ans. \\ \underline{81} \\ 3 \\ \underline{3} \\ 0 \end{array}$$

Reduce  $\frac{81}{9}$  to its proper terms. *Ans.*  $9\frac{3}{9}$ .

Reduce  $\frac{16}{17}$  to its proper terms. *Ans.*  $9\frac{1}{17}$ .

Reduce  $\frac{7}{8}$  to its proper terms. *Ans.*  $8\frac{1}{8}$ .

*To reduce fractions of one denomination to that of another of an equal value.*

Reduce  $\frac{1}{4}$  of a farthing to the fraction of a pound.\*

$$\frac{1}{4} \times \frac{1}{2} \times \frac{1}{12} \times \frac{1}{20} = \frac{1}{1600} = \frac{1}{1600} \text{ } £. \text{ } Ans.$$

Reduce 16s. to the fraction of a pound. *Ans.*  $\frac{1}{2}$ .

Reduce 4s. 6d. to the fraction of a pound. *Ans.*  $\frac{9}{16}$ .

\* If it be a small name to a great, multiply the *denominator*; but if it be a great name to a small, multiply the *numerator*.

Reduce 7s.  $3\frac{1}{2}$ d. to the fraction of a shilling.

*Ans.*  $\frac{17}{14}$ .

Reduce 13s.  $8\frac{1}{2}$ d. to the fraction of a guinea.

*Ans.*  $\frac{7^2}{1^2}$ .

Reduce 2 roods 20 poles to the fraction of an acre.

*Ans.*  $\frac{5}{8}$ .

Reduce 2 qrs. 14 lb. 1 oz. to the fraction of a cwt.

*Ans.*  $\frac{1^2}{3^2}$ .

Reduce 6 fur. 16 poles to the fraction of a mile.

*Ans.*  $\frac{2}{3}$ .

Reduce 48 gallons to the fraction of a hogshead of beer.

*Ans.*  $\frac{2}{3}$ .

Reduce 3 cwt. 2 qr. 8 lb. to the fraction of a ton.

*Ans.*  $\frac{2}{3}$ .

*To find the value of a fraction.*

What is the value of  $\frac{2}{3}$  of a pound?

$$\frac{2}{3} \times 1^s = \frac{2^s}{3} = 12\frac{2}{3}$$

$$\frac{2}{3} \times 1^s = 4^d = 6 \text{ Ans. } 12s. 6d.$$

What is the value of  $\frac{2}{3}$  of a guinea? *Ans.* 7s.  $10\frac{2}{3}$ d.

What is the value of  $\frac{2}{3}$  of a crown? *Ans.* 3s.

What is the quantity of  $\frac{2}{3}$  of a lb. troy?

*Ans.* 7 oz. 10 dwt.

What is the measure of  $\frac{2}{3}$  of a hhd. of beer?

*Ans.* 16 gal.  $1\frac{2}{3}$  pt.

What is the measure of  $\frac{2}{3}$  of a pipe of wine?

*Ans.* 100 gal.  $3\frac{1}{3}$  qt.

What is the space of  $\frac{2}{3}$  of a day? *Ans.* 14 h. 24 m.

What is the distance of  $\frac{2}{3}$  of a mile?

*Ans.* 1 fur. 20 po.

What is the portion of  $\frac{3}{8}$  of an acre?

*Ans.* 1 rood, 20 poles.

What is the division of  $\frac{3}{4}$  of a day?

*Ans.* 14 hours, 24 minutes.

*To reduce fractions of one denomination to fractions of greater denominations, retaining the same value.*

Reduce  $\frac{3}{8}$  of a penny to the fraction of a pound.

$$\frac{3}{8} \times \frac{1}{12} \times \frac{1}{20} = \frac{3}{1600} \text{ £. } \textit{Ans.}$$

Reduce  $\frac{3}{4}$  of a shilling to the fraction of a pound.

$$\textit{Ans. } \frac{3}{160}.$$

Reduce  $\frac{1}{2}$  of a yard to the fraction of a mile.

$$\textit{Ans. } \frac{1}{3200}.$$

Reduce  $\frac{3}{4}$  of a crown to the fraction of a pound.

$$\textit{Ans. } \frac{3}{16}.$$

Reduce  $\frac{3}{8}$  of a farthing to the fraction of a guinea.

$$\textit{Ans. } \frac{3}{640}.$$

Reduce  $\frac{3}{8}$  lb. to the fraction of a ton.

$$\textit{Ans. } \frac{1}{8000}.$$

Reduce  $\frac{6}{7}$  oz. to the fraction of a cwt.

$$\textit{Ans. } \frac{3}{784}.$$

Reduce  $\frac{1}{440}$  of a ton to the fraction of a lb. *Ans.*  $\frac{1}{4}.$

Reduce  $\frac{3}{7}$  of a gallon to the fraction of a butt.

$$\textit{Ans. } \frac{3}{728}.$$

Reduce  $\frac{1}{12}$  of an inch to the fraction of a mile.

$$\textit{Ans. } \frac{1}{768000}.$$

Reduce  $\frac{1}{360}$  of a pound to the fraction of a guinea.

$$\textit{Ans. } \frac{1}{378}.$$

Reduce  $\frac{3}{8}$  of a pennyweight to the fraction of a lb.

$$\textit{Ans. } \frac{1}{640}.$$

Reduce  $7\frac{1}{2}$  hours to the fraction of a day. *Ans.*  $\frac{3}{16}.$

Reduce  $14\frac{3}{4}$  inches to the fraction of a yard. *Ans.*  $\frac{3}{4}.$

## ADDITION OF VULGAR FRACTIONS.

**MAKE** the fractions all alike, and reduce them to a common denominator; then add the numerators together, and under the same place the common denominator.

Add  $\frac{3}{8}$ ,  $\frac{5}{8}$ , and  $\frac{6}{7}$  together.

$$\begin{array}{r}
 3 \times 8 \times 7 = 168 \\
 5 \times 4 \times 7 = 140 \\
 6 \times 4 \times 8 = 192 \\
 \hline
 500 \\
 4 \times 8 \times 7 = 224
 \end{array}
 = 2 \frac{52}{112} \text{ Ans.}$$

Or thus:—

$$\frac{168 + 140 + 192}{224} = \frac{500}{224} = 2 \frac{52}{112} \text{ Ans.}$$

Find the value of  $\frac{1}{4}$ ,  $4\frac{1}{8}$ , and  $\frac{3}{8}$ . *Ans.*  $5\frac{1}{4}$ .

Add  $3\frac{1}{8}$ , and  $\frac{3}{8}$  of  $\frac{1}{8}$  together. *Ans.*  $3\frac{2}{8}$ .

What is the sum of  $5\frac{1}{2}$ ,  $6\frac{1}{8}$ , and  $4\frac{3}{4}$ ? *Ans.*  $17\frac{5}{8}$ .

Add  $\frac{3}{8}$ ,  $\frac{1}{8}$ , and  $\frac{6}{16}$  together. *Ans.*  $2\frac{7}{8}$ .

Find the sum of  $\frac{1}{8}$ ,  $\frac{1}{8}$ ,  $\frac{1}{8}$ , and  $\frac{1}{8}$ . *Ans.*  $\frac{4}{8}$ .

Add together  $2\frac{3}{8}$ ,  $5\frac{1}{4}$ ,  $11\frac{1}{8}$ , and  $5\frac{1}{8}$ . *Ans.*  $24\frac{1}{4}$ .

To  $\frac{2}{3}$  of a pound add  $\frac{3}{4}$  of a shilling.

$$\frac{2}{3} \times \frac{10}{1} = \frac{20}{3} = 12\frac{2}{3} \text{ s.}$$

$$\frac{3}{4} \times \frac{1}{1} = \frac{3}{4} = 8 \text{ d.}$$

$$\frac{4}{8} \times \frac{1}{1} = \frac{4}{8} = 6 \text{ d.}$$

$$\begin{array}{r}
 \text{s.} \quad \text{d.} \\
 12 \quad 6 = \frac{2}{3} \text{ of a pound.} \\
 0 \quad 8 = \frac{3}{4} \text{ of a shilling.}
 \end{array}$$

$$\text{Ans. } \underline{\underline{13 \quad 2}}$$

What is the sum of  $\frac{1}{2}$  of a £,  $\frac{1}{4}$  of a shilling, and  $\frac{1}{8}$  of a sixpence?  
*Ans.* 12s. 2½d.  $\frac{1}{8}$ .

Required the sum of  $\frac{1}{2}$  of £15,  $3\frac{1}{2}$  of a £,  $\frac{1}{2}$  of  $\frac{1}{4}$  of  $\frac{1}{2}$  of a £, and  $\frac{1}{2}$  of  $\frac{1}{4}$  of a shilling.  
*Ans.* £7 17s. 5½d.

Add together  $\frac{1}{2}$  of a foot,  $\frac{1}{4}$  of a yard, and  $\frac{1}{8}$  of a mile.  
*Ans.* 1540 yds. 2 ft. 9 in.

What is the sum of  $\frac{1}{2}$  of a hogshead of beer, and  $\frac{1}{4}$  of a barrel?  
*Ans.* 62 gal.  $\frac{1}{2}$  pt.

Add together  $\frac{1}{16}$  of a cwt.,  $\frac{1}{4}$  of a qr., and  $\frac{1}{16}$  of a lb.  
*Ans.* 1 qr. 13 lb. 13 oz. 1 dr.  $\frac{1}{16}$ .

What is the sum of  $\frac{1}{16}$  of a ton, and  $\frac{1}{16}$  of a cwt.?  
*Ans.* 9 cwt. 16 lb. 15 oz.  $\frac{1}{16}$ .

Add  $\frac{1}{2}$  of a day, and  $\frac{1}{16}$  of an hour together.  
*Ans.* 16 ho. 12 min. 30 sec.

Find the amount of £4½, £5½, and £11½.  
*Ans.* £21  $\frac{1}{16}$ , or £21 6s. 3d.

## SUBTRACTION OF VULGAR FRACTIONS.

PREPARE the fractions as in Addition; then subtract the less numerator from the greater, and place the remainder over the common denominator.

Take  $\frac{1}{8}$  from  $\frac{1}{4}$ .

$$7 \times 5 = 35$$

$$3 \times 8 = 24$$

$$\begin{array}{r} 11 \\ 8 \times 5 = 40 \end{array} \text{Ans.}$$

Or thus:—

$$\frac{35 - 24}{40} = \frac{11}{40} \text{Ans.}$$

- Take  $\frac{3}{4}$  from  $\frac{9}{10}$ . *Ans.*  $\frac{11}{20}$ .  
 What is the difference of  $\frac{3}{4}$  and  $\frac{1}{3}$ ? *Ans.*  $\frac{7}{12}$ .  
 From  $\frac{2}{3}$  of 9, take  $1\frac{1}{3}$ . *Ans.*  $2\frac{2}{3}$ .  
 From 60 take  $\frac{2}{3}$  of 60. *Ans.*  $17\frac{1}{3}$ .  
 From  $19\frac{1}{2}$  take  $\frac{1}{2}$  of  $\frac{2}{3}$  of  $8\frac{1}{2}$ . *Ans.*  $13\frac{1}{6}$ .  
 From  $\frac{3}{4}$  of a £ take  $\frac{2}{3}$  of a shilling. *Ans.* 14s.  $7\frac{1}{2}$ d.  
 From  $\frac{2}{3}$  of a guinea take  $\frac{1}{3}$  of a £. *Ans.* 5s. 4d.  
 From  $\frac{2}{3}$  of a ton take  $\frac{1}{3}$  of  $\frac{2}{3}$  of a cwt. *Ans.* 13 cwt. 3 qr. 18 lb.  
 Take  $\frac{2}{3}$  of  $\frac{2}{3}$  of £5 from 100 half-crowns. *Ans.* £11 12s.  $1\frac{1}{2}$ d.  
 From  $\frac{2}{3}$  of a league take  $\frac{7}{10}$  of a mile. *Ans.* 1 mi. 2 fur. 16 po.

## MULTIPLICATION OF FRACTIONS.

LET the fractions be prepared as before; then multiply all the numerators together for the numerator of the product, and all the denominators for the denominator.

Multiply ? by  $\frac{9}{10}$ .

$$\begin{array}{rcl} 7 \times 9 & = & 63 \\ 8 \times 10 & = & 80 \end{array} \text{Ans.}$$

- Multiply  $\frac{2}{3}$  by  $8\frac{3}{4}$ . *Ans.*  $6\frac{7}{10}$ .  
 Multiply 14 by  $4\frac{3}{4}$ . *Ans.*  $66\frac{1}{2}$ .  
 Multiply  $\frac{1}{2}$  by  $4\frac{1}{4}$ . *Ans.*  $2\frac{1}{8}$ .  
 Multiply  $48\frac{1}{2}$  by 7. *Ans.*  $337\frac{1}{2}$ .  
 Multiply  $\frac{2}{3}$  of  $\frac{3}{4}$  by  $\frac{2}{3}$  of  $2\frac{1}{2}$ . *Ans.*  $\frac{5}{6}$ .  
 Value 14 yards at  $1\frac{1}{2}$  £. *Ans.* £3 17s.  
 Multiply  $71\frac{1}{2}$  of a cwt. by  $3\frac{7}{8}$ . *Ans.*  $278\frac{5}{8}$  cwt.

## DIVISION OF VULGAR FRACTIONS.

PREPARE the fractions as in the former rules; then *invert* the divisor, and proceed as in Multiplication.

Divide  $\frac{2}{3}$  by  $\frac{1}{5}$ .

$$\frac{2}{3} \times \frac{5}{1} = \frac{10}{3} = 3\frac{1}{3} \text{ Ans.}$$

Divide  $3\frac{1}{2}$  by  $9\frac{1}{2}$ .

*Ans.*  $\frac{1}{3}$ .

Divide  $15\frac{2}{3}$  by  $\frac{1}{7}$  of  $\frac{1}{17}$ .

*Ans.*  $65\frac{1}{17}$ .

Divide 9 by  $\frac{2}{3}$ .

*Ans.*  $13\frac{1}{2}$ .

Divide  $\frac{1}{2}$  of  $\frac{2}{3}$  of 18 by  $\frac{1}{4}$  of  $\frac{7}{10}$ .

*Ans.*  $2\frac{1}{5}$ .

Divide  $14\frac{1}{2}$  by  $3\frac{1}{3}$ .

*Ans.*  $18\frac{1}{3}$ .

Divide  $456\frac{1}{2}$  by  $3\frac{1}{2}$ .

*Ans.*  $130\frac{1}{5}$ .

Divide  $17\frac{1}{10}$  miles by  $\frac{1}{4}$  of 3.

*Ans.*  $13\frac{1}{5}$ .

Divide a prize of £2450  $\frac{1}{2}$  into  $40\frac{1}{2}$  shares.

*Ans.* £60 12s. 11d.

Divide  $8\frac{2}{3}$  by  $\frac{1}{2}$  of  $\frac{1}{3}$  of 5.

*Ans.*  $4\frac{2}{5}$ .

Divide 16 by  $2\frac{1}{2}$ .

*Ans.*  $\frac{8}{5}$ .

## THE RULE OF THREE IN VULGAR FRACTIONS.

PREPARE the fractions, if required, so that they may be of the same name; state the question just like the Rule of Three in whole numbers; multiply the second and third terms together, and likewise by the first with its parts *inverted*; and the product will be the answer in the same denomination in which the second term was left.

If  $\frac{2}{3}$  yd. cost £7, what will  $5\frac{1}{2}$  yds. cost?

*Ans.* £5 8s.  $10\frac{1}{2}$ d.  $\frac{1}{3}$ .

$$\frac{3}{4} : \frac{7}{9} :: \frac{5\frac{1}{2}}{4} : \frac{588}{108} = £5 \text{ 8s. } 10\frac{1}{2}\text{d. } \frac{1}{3}.$$

If  $\frac{1}{3}$  of a gallon of wine cost £ $\frac{2}{3}$ , what will  $\frac{1}{3}$  of a tun cost?  
*Ans.* £105.

If 10 gallons of brandy cost £21  $\frac{1}{2}$ , what will a hhd. cost?  
*Ans.* £136 4s. 9d.

Received for  $\frac{1}{4}$  of a cwt. of lead 24  $\frac{3}{4}$ s., how much should 8  $\frac{1}{2}$  cwt. come to?  
*Ans.* £40 16s. 6  $\frac{1}{2}$ d.

If 6 dozen lbs. of candles cost £3  $\frac{1}{4}$ , what will be the price of 1 lb.?  
*Ans.* 10  $\frac{1}{2}$ d.  $\frac{1}{4}$ f.

If  $\frac{1}{3}$  of a ship cost £445 15s., what will  $\frac{7}{12}$  of her be worth?  
*Ans.* £2080 3s. 4d.

If 1  $\frac{1}{2}$  lb. of gold be worth £61  $\frac{1}{2}$  sterling, what must be charged for 2 grains?  
*Ans.* 3d.

If a stationer bought 4  $\frac{1}{2}$  quires of foolscap at 4  $\frac{1}{2}$ d. a quire, what are 15  $\frac{1}{4}$  reams worth at the same rate?  
*Ans.* £5 18s. 1  $\frac{1}{2}$ d.

How many lbs. of tobacco can be purchased for £15  $\frac{3}{8}$ , at the rate of 28  $\frac{1}{4}$ s. per cwt.?  
*Ans.* 1207 lb. 10 oz. 6 dr.

If 9 men can perform a piece of work in 15  $\frac{1}{2}$  days, in what time will 23 men do the same?  
*Ans.* 6  $\frac{1}{3}$   $\frac{1}{4}$  days.

If I have 7  $\frac{1}{3}$  cwt. carried for 8s. 7  $\frac{1}{2}$ d., what weight can I have carried for £5  $\frac{1}{4}$ ?  
*Ans.* 94 cwt. 0 qrs. 1 lb.  $\frac{13}{16}$   $\frac{1}{4}$ .

If 1 yard of broad cloth cost 15  $\frac{3}{8}$ s., what will 4 pieces, each containing 27  $\frac{3}{8}$  yards, come to?  
*Ans.* £85 10s. 11  $\frac{1}{2}$ d.

If  $\frac{1}{3}$  of a sloop be worth £73 1s. 3d., what part of her is worth £250 10s.  
*Ans.*  $\frac{2}{3}$ .

If 7 masons can erect a certain piece of wall in 20  $\frac{3}{8}$  days of 9  $\frac{1}{2}$  hours each, how long would it take 3 masons to erect 2  $\frac{3}{8}$  times as much of the same work, reckoning 12 hours to the day?  
*Ans.* 86  $\frac{3}{8}$  days.



## DECIMAL FRACTIONS.

DECIMAL FRACTIONS are such as have a unit for their denominator, with as many noughts or ciphers annexed as there are figures in the numerator; as  $\frac{2}{10}$ ,  $\frac{34}{100}$ ,  $\frac{564}{1000}$ , usually written with a point prefixed without the denominator: thus,  $\cdot 2$ ,  $\cdot 34$ ,  $\cdot 564$ ; which we read in this manner:  $\cdot 2$ —2 tenths;  $\cdot 34$ —thirty-four hundredth parts;  $\cdot 564$ —five hundred and sixty-four thousandth parts; and so on.\*

## ADDITION OF DECIMALS.

What is the sum of £3·15, £2·031, £·4085, £30·67, and £·0084?

$$\begin{array}{r} £3\cdot15 \\ 2\cdot031 \\ \cdot4085 \\ 30\cdot67 \\ \cdot0084 \\ \hline \end{array}$$

£36·2679 *Ans.*

What is the total quantity of 2·64 yds., 85·6 yds., ·945 yds., 14·8 yds., ·3456 yds., and 84 yds.? *Ans.* 188·3306.

Add up 23, ·1817, 5·5, 84621, ·0001, 38·472, and 3·816. *Ans.* 84691·9698.

## SUBTRACTION OF DECIMALS.

Take £·8495 from £3·6954; and £2·0134 from £3·0022.

$$\begin{array}{r} £3\cdot6954 \\ \cdot8495 \\ \hline \end{array}$$

£2·8459 *Ans.*

$$\begin{array}{r} £3\cdot0022 \\ 2\cdot0134 \\ \hline \end{array}$$

£·9888 *Ans.*

What is the difference between £246, and £·8154? *Ans.* £245·1846.

If I borrow £20·78125, and pay in part £14 18s. 9d., what sum remains due? *Ans.* £5 16s. 10½d.

\* Ciphers on the right hand of decimals do not alter their value.

Find the difference between 40 yds. 2 qrs. of cloth,  
and 29·625 yds. *Ans.* 10 yds. 3 qr. 2 na.

### MULTIPLICATION OF DECIMALS.

Multiply as in whole numbers, only taking care to point off as many decimal places in the product towards the right hand as there are decimals in the multiplier and multiplicand; and if the product be not so many, supply the defect by putting ciphers on the *left hand*.

Multiply ·124 by ·165, and 2·45 by 15·4.

·124	2·45
·165	15·4
—	—
620	980
744	1225
124	245
—	—
·020460 <i>Ans.</i>	37·730 <i>Ans.</i>

Multiply 346·549 by 3·15. *Ans.* 1091·62935.

Multiply ·84615 by ·065. *Ans.* ·05499975.

Multiply 3·081 by 4·12. *Ans.* 12·69372.

Multiply 7·001 by ·001. *Ans.* ·007001.

Multiply 1008 by ·1008. *Ans.* 101·6064.

Multiply ·83125 by the number of days in a year.  
*Ans.* 303·40625.

### DIVISION OF DECIMALS.

Divide as in whole numbers, and point off as many decimal places in the quotient, as the dividend has more than the divisor.\*

\* If there are not as many decimal places in the quotient as required, supply the defect by writing ciphers on the left hand.

If there be a remainder, the quotient may be carried to any degree of exactness by annexing ciphers; or, if the decimal places in the divisor be more than those in the dividend, ciphers may be annexed to the dividend.

If the dividend will not contain the divisor, ciphers must be added thereto.

Divide 24·694 by ·45.

$$\begin{array}{r}
 \cdot 45 \overline{) 24 \cdot 694} \quad ( 54 \cdot 8 + \text{Ans.} \\
 \underline{225} \\
 219 \\
 \underline{180} \\
 394 \\
 \underline{360} \\
 34
 \end{array}$$

Divide 27·462837 by 4·35. *Ans.* 6·3132 <sup>411</sup>.

Divide ·75 by 8. *Ans.* ·09375.

Divide ·382 by ·347. *Ans.* 1·10086 +.

Divide 1 by ·1. *Ans.* 10.

Divide ·06548 by 215. *Ans.* ·00030 <sup>22</sup>.

Divide ·21468 by 2·5. *Ans.* ·085872.

### REDUCTION OF DECIMALS.

*To reduce a vulgar fraction to a decimal.*

What is the decimal of  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$ ?

$$4 \overline{) 1 \cdot 00}$$

$$\text{Ans. } \cdot 25$$

$$2 \overline{) 1 \cdot 0}$$

$$\text{Ans. } \cdot 5$$

$$4 \overline{) 3 \cdot 00}$$

$$\text{Ans. } \cdot 75$$

What is the decimal of  $\frac{1}{8}$ ? *Ans.* ·125.

What is the decimal of  $\frac{3}{8}$ ? *Ans.* ·625.

Reduce  $\frac{6}{8}$  to a decimal. *Ans.* ·75.

Reduce  $\frac{7}{8}$  to a decimal. *Ans.* ·875 +.

*If the number given consist of several denominations.*

Reduce 15s. 6½d. to the decimal of a pound sterling.

s.	d.	£	s.	
15	6½	1 or 20		Or thus, more concisely :—
12		12		4 ) 3·00
<hr/>				
186		240		12 ) 6·75
4		4		
<hr/>				
747		960		2,0 ) 15·5625
<hr/>				
				<hr/> ·778125 £. <i>Ans.</i>

Then, 747 divided by 960 = ·778125 £. *Ans.*

Reduce 17s. to the decimal of a pound. *Ans.* ·85.

Reduce 8s. 4d. to the decimal of a pound.

*Ans.* ·4166 +.

Reduce 9d. to the decimal of a pound. *Ans.* ·0375.

Reduce 5 cwt. 2 qr. 10 lb. to the decimal of a ton.

*Ans.* ·2794 +.

Reduce 2 qr. 14 lb. to the decimal of a cwt. *Ans.* ·625.

Reduce 2 gal. 1 qt. of beer to the decimal of a barrel.

*Ans.* ·0625.

Reduce 52 days to the decimal of a year.

*Ans.* ·142465 +.

Reduce 3 qrs. 3 na. to the decimal of an English ell.

*Ans.* ·75.

*To find the value of any decimal.*

What is the value of ·525 of a pound? *Ans.* 10s. 6d.

$$\begin{array}{r}
 \cdot 525 \\
 20 \\
 \hline
 10 \cdot 500 \\
 12 \\
 \hline
 6 \cdot 00 \\
 \hline
 \end{array}$$

What is the value of  $\cdot 8475$  of a pound?

*Ans.* 16s. 11½d.

What is  $\cdot 6845$  of a cwt.? *Ans.* 2qr. 20lb. 10oz. 9dr.

What is  $\cdot 03125$  of a barrel of beer? *Ans.* 1 gal. 1 pt.

What is the length of  $\cdot 28$  of a mile?

*Ans.* 2 fur. 9 po. 3 yd. 10·8 in.

What is the measure of  $\cdot 251$  of an acre?

*Ans.* 1 ro. 4 yd. 7 ft.

### THE RULE OF THREE IN DECIMALS.

If 1·25 yards of cloth cost  $\cdot 625$  £, what cost  $30\frac{3}{4}$  yards?

yds.	£	yds.	
If 1·25	: $\cdot 625$	: :	30·75
			$\cdot 625$
			<hr/>
			15375
			6150
			<hr/>
			18450
			<hr/>
			£
1·25)	19·21875	(15·375	
	125	20	
	<hr/>		
	671	7·500	
	625	12	
	<hr/>		
	468	6·000	
	375		
	<hr/>		
	937		
	875		
	<hr/>		
	625		
	625		
	<hr/>		

*Ans.* £15 7s. 6d.

How many pounds of tea will £30 purchase at 11·125s. for 2 lb.?

*Ans.* 107·865.

If  $\frac{1}{4}$  lb. of silk cost 8s. 6d., what will 20·5 lb. cost?

*Ans.* £34·85.

If 3 bushels of wheat cost £1·1, what will 33·4 qrs. come to? *Ans.* £97·97.

If for 4 weeks' salary I receive £5·825, how much do I have annually? *Ans.* £75·725.

What must my income be to enable me to spend daily 15s. 6d., and lay by at the year's end £123·55? *Ans.* £406·425.

How much pepper at 1s. 4½d. per lb. can I buy for £12 15s. 9d.? *Ans.* 1 cwt. 2 qr. 18 lb.

If 1 ounce of silver cost 5s. 6d., what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwt. 4 gr.? *Ans.* £6 3s. 9½d. ½.

If 26½ yards of linen cost £3 16s. 3d., what will 32½ yards come to? *Ans.* £4 12s. 9½d. ¼.

A merchant bought 3 cwt. 1 qr. 14 lb. of sugar at £0·34375 per lb., and sold it in wholesale for £16·5375; what did he gain or lose by the bargain, and at how much per cent.?

*Ans.* He gained £3 10s. 10½d.; per cent., £27·¼.

## EXTRACTION OF THE SQUARE ROOT.

DIVIDE the given numbers into periods of *two* figures each, beginning at the right hand, and pointing towards the left in integers, and towards the right hand in decimals. Every period will give one figure in the root.\*

What is the square root of 144?

$$\begin{array}{r}
 \begin{array}{r}
 \cdot \\
 \cdot \\
 144 \text{ (12 } \textit{Ans.} \\
 \cdot \\
 1 \\
 \hline
 22 \text{ ) } 44 \\
 \underline{44}
 \end{array}
 \end{array}$$

Proof,  $12 \times 12 = 144$ .

\* The method of solving the sums will be better explained by the teacher, either from his own *practical* knowledge, or from the rules of instruction laid down by some judicious and experienced writer. The same observation will hold good as to the *Cube Root*, and *also* the end more effectually.

- What is the square root of 40804? *Ans.* 202.  
 What is the square root of 125316? *Ans.* 354.  
 What is the square root of 59049? *Ans.* 243.  
 What is the square root of 2187441? *Ans.* 1479.  
 What is the square root of 2916? *Ans.* 54.  
 What is the square root of 421685? *Ans.* 649  $\frac{11}{10}$ .  
 What is the square root of 0064? *Ans.* 08.  
 What is the square root of 001? *Ans.* 0316227.

*To find the square root of a vulgar fraction.*

What is the square root of  $\frac{1}{8}\frac{7}{8}$ ?

$$75) \frac{1}{8}\frac{7}{8} = \frac{2}{3} \text{ and } \sqrt{\frac{2}{3}} = \frac{1}{3} \text{ Ans.}$$

What is the square root of  $\frac{3}{8}\frac{3}{8}$ ? *Ans.*  $\frac{1}{2}$ .

What is the square root of  $\frac{7}{4}\frac{1}{4}$ ? *Ans.*  $\frac{1}{2}$ .

*To find the square root of a mixed number.*

What is the square root of  $6\frac{1}{2}$ ?

$$\begin{array}{r} 6\frac{1}{2} \\ 25 \end{array}$$

$$\sqrt{1\frac{6}{5}} = \frac{1}{2} = 2\frac{3}{5} \text{ Ans.}$$

What is the square root of  $9\frac{1}{2}$ ? *Ans.*  $3\frac{1}{2}$ .

What is the root of  $\frac{3}{4}\frac{3}{4}$ ? *Ans.*  $\frac{1}{2}$ .

What is the square root of  $4\frac{1}{2}$ ? *Ans.*  $2\cdot144761$ .

## APPLICATION.

In a square plantation containing 505995 trees, each 6 feet distant, what is the length of the side?

*Ans.* 4268 feet, nearly.

A gentleman has two fields, the first contains 8 ac. 2 r. 1 p., the second, 6 ac. 2 r.; he wishes to exchange them for a square field; required the side of the square.

*Ans.* 49 poles.

A person has two circular ponds in his pleasure ground, the diameter of the one is 200 feet, and the other three times as large; what is its diameter? *Ans.* 346·4 704.

## EXTRACTION OF THE CUBE ROOT.

DIVIDE the given numbers into periods of *three* figures each, beginning at the right hand in the integers or whole numbers, and pointing towards the left; but in decimals, begin at the place of thousandths, and point towards the right.

What is the cube root of 1728?

		1728 (12 <i>Ans.</i>
1	1	1
1	2	<u>1</u>
<u>2</u>	<u>3</u>	728
1	64	
<u>32</u>	<u>364</u>	<u>728</u>

What is the cube root of 48228544?

		48228544 (364 <i>Ans.</i>
3	9	27
3	18	<u>27</u>
<u>6</u>	<u>27</u>	21228
3	576	
<u>96</u>	<u>3276</u>	19656
6	612	<u>1572544</u>
<u>102</u>	<u>3888</u>	
6	4336	<u>1572544</u>
<u>1084</u>	<u>393136</u>	



What is the cube root of 80677568161 ?

		80677568161 (4321 <i>Ans.</i>
4	16	64
<u>4</u>	<u>32</u>	<u>16677</u>
8	48	
<u>4</u>	<u>369</u>	
123	5169	15507
<u>3</u>	<u>378</u>	<u>1170568</u>
126	5547	
<u>3</u>	<u>2584</u>	
1292	557284	1114568
<u>2</u>	<u>2588</u>	<u>56000161</u>
1294	559872	
<u>2</u>	<u>12961</u>	
12961	56000161	56000161

What is the cube root of 200 ?

		200 (5.8480354 <i>Ans.</i>
5	25	125
<u>5</u>	<u>50</u>	<u>75000</u>
10	75	
<u>5</u>	<u>1264</u>	
158	8764	70112
<u>8</u>	<u>1328</u>	<u>4888000</u>
166	10092	4064704
<u>8</u>	<u>6976</u>	<u>823296</u>
1744	1016176	819656
<u>4</u>	<u>6992</u>	
1748	102316,8	3640
<u>4</u>	<u>140,2</u>	<u>3078</u>
17,52	102457,0	562
	<u>140,2</u>	<u>518</u>
	1025,9,7	49
		<u>41</u>
		8

In this example we have obtained 8 figures of the root with much facility, by contracting the operation after the second figure of decimals. With each figure of the root, the left column is extended *one* figure towards the right, and the middle column *two* figures; hence by omitting the period of *three* figures from the right column, *one* from the middle column, and *two* from the left, we are in effect cutting off *three* figures from each column, and working with the remaining figures.

What is the cube root of 5735339? *Ans.* 179.

Find the cube root of 12821119155125. *Ans.* 23405.

What is the cube root of 12·977875? *Ans.* 2·35.

What is the cube root of 14706·125? *Ans.* 2·45.

What is the cube root of 444194947? *Ans.* 763.

What is the cube root of  $37\frac{1}{4}$ ? *Ans.*  $3\frac{1}{3}$ .

What is the cube root of  $1953\frac{1}{8}$ ? *Ans.*  $12\frac{1}{2}$ .

What is the cube root of  $1\frac{3}{8}\frac{8}{9}\frac{7}{11}\frac{1}{13}$ ? *Ans.*  $\frac{3}{4}$ .

What is the cube root of ·0001? *Ans.* ·0464158.

What is the cube root of 3456? *Ans.* 15·1190526.

### APPLICATION.

If a cubical piece of timber be 47 inches long, 47 inches broad, and 47 inches deep; how many cubical inches does it contain? *Ans.* ·103820.

There is a cellar dug that is 12 feet every way, in length, breadth, and depth; how many solid feet of earth were taken out of it? *Ans.* 1728.

There is a stone of cubic form which contains 389017 solid feet; what is the superficial content of one of its sides? *Ans.* 5329.

What is the side of a cubical vessel which holds 63 imperial gallons? *Ans.* 25·94676 inches.

### DUODECIMALS.

DUODECIMALS, or, as it is usually called, *Cross Multiplication*, is a rule used by workmen and artificers in calculating the content of their work; the length,

breadth, and depth, being given in feet, inches, seconds, thirds, &c. \*

Feet  $\times$  by feet give feet.

Feet  $\times$  by inches give inches.

Feet  $\times$  by seconds give seconds.

Inches  $\times$  by inches give seconds.

Inches  $\times$  by seconds give thirds.

Seconds  $\times$  by seconds give fourths.

12 Fourths = 1 third.

12 Thirds = 1 second, or part.

12 Seconds = 1 inch.

12 Inches = 1 foot.

Multiply 6 feet 3 inches by 3 feet 3 inches.

$\begin{array}{r} \text{ft. in.} \\ 6 \ 3 \\ 3 \ 3 \\ \hline 18 \ 9 \\ 1 \ 6 \ 9 \\ \hline \end{array}$	$\begin{array}{r} \text{ft. in.} \\ \text{Or, } 6 \ 3 \\ \phantom{\text{Or, }} 3 \ 3 \\ \hline 1 \ 6 \ 9 \\ 18 \ 9 \\ \hline \end{array}$	$\begin{array}{r} \text{ft. in.} \\ \text{Or, } 3 = \frac{1}{4} ) \ 6 \ 3 \\ \phantom{\text{Or, }} 3 \\ \hline 18 \ 9 \\ 1 \ 6 \ 9 \\ \hline \end{array}$
$\text{Ans. } 20 \ 3 \ 9$	$\text{Ans. } 20 \ 3 \ 9$	$\text{Ans. } 20 \ 3 \ 9$

Or thus, *fractionally* :—

$$\begin{array}{r} 6\frac{1}{4} \quad 3\frac{1}{4} \\ 4 \quad 4 \\ \hline \end{array}$$

$$\frac{2^5}{4} \times \frac{1^3}{4} = \frac{1^2 5}{16} = 20\frac{5}{16} \text{ feet.}$$

Then,  $\frac{5}{16} \times \frac{1^2}{1} = \frac{5}{16} = 3\frac{1}{4} \text{ in.}$

$$\frac{1^2}{16} \times \frac{1^3}{1} = \frac{1^4 4}{16} = 9 \text{ pts.}$$

$\text{Ans. } 20 \text{ ft. } 3 \text{ in. } 9 \text{ pts.}$

Or thus, *decimally* :—

$$\begin{array}{r} 6.25 \\ 3.25 \\ \hline 3125 \\ 1250 \\ 1875 \\ \hline 20.8125 \\ 12 \\ \hline 3.7500 \\ 12 \\ \hline 9.0000 \\ \hline \end{array}$$

$\text{Ans. } 20 \text{ ft. } 3 \text{ in. } 9 \text{ pts.}$

\* Place the multiplier under the multiplicand, feet under feet, inches under inches, seconds under seconds, &c. ; and then proceed according to the rule which may be laid before you, or by the verbal directions of your tutor.

Multiply 7 feet 6 inches by 4 feet 9 inches.

*Ans.* 35 ft. 7 in. 6 pts.

Multiply 3 ft. 6 in. by 2 ft. 7 in.

*Ans.* 9 ft. 0 in. 6 pts.

Multiply 6 ft. 3 in. by 3 ft. 2 in.

*Ans.* 19 ft. 9 in. 6 pts.

Multiply 6 ft. 4 in. 3 pts. by 4 ft. 3 in. 6 pts.

*Ans.* 27 ft. 3 in. 2 p. 10 th. 6 fourths.

Multiply 56 ft. 1 in. 4 pts. by 48 ft. 3 in. 6 pts.

*Ans.* 2709 ft. 8 in. 4 s. 8 th.

## MENSURATION.\*

MENSURATION is of three kinds, lineal, superficial, and solid.

*Lineal* respects length only.

*Superficial* includes length and breadth.

*Solid* comprehends length, breadth, and depth.

## GLAZIERS' WORK.

What will a piece of glass that is 7 ft. 4 in. long, and 5 ft. 6 in. broad, come to at 6s. per square foot?

ft.	in.		ft.	in.		Or, 6 in. ( $\frac{1}{2}$ )	ft.	in.
7	4		7	4			7	4
5	6		5	6			5	5
<hr/>			<hr/>				<hr/>	
36	8		3	8	0		36	8
3	8	0	36	8			3	8
<hr/>			<hr/>				<hr/>	
40	4	0	40	4	0		40	4
<hr/>			<hr/>				<hr/>	

\* Artificers' work is computed by different measures, viz. :—

Glazing, and Masons' flat work, by the foot.

Painting, plastering, paving, &c., by the yard.

Partitioning, flooring, roofing, tiling, &c., by the square of 100 feet.

Brickwork, &c., by the rod, or  $16\frac{1}{2}$  feet, whose square is  $272\frac{1}{4}$  feet, which is reckoned a rod of walling.

			Or thus:—		
ft.		s.	£.	s.	d.
40	$4\left(\frac{1}{3}\right)$	6	0	6	0
6		<hr/>			10
		*2			<hr/>
240		<hr/>	3	0	0
2* add.					4
<hr/>					<hr/>
2,0 ) 24,2			12	0	0
				2	
<hr/>					<hr/>
Ans. £12	2s.		Ans. £12	2	0
					<hr/>

If a pane of glass be 2 ft. 3 in. long, and 1 ft. 6 in. broad, how many feet does it contain? *Ans.* 3 ft. 4 in. 6 pts.

What is the worth of 8 squares of glass, each measuring 4 ft. 10 in. long, and 2 ft. 11 in. broad, at  $4\frac{1}{2}$  d. a foot? *Ans.* £2 2s.  $3\frac{1}{2}$  d.

There are 8 windows to be glazed, each measuring 1 ft. 6 in. wide, and 3 ft. high; how much will they come to at  $7\frac{3}{4}$  d. per foot? *Ans.* £1 3s. 3d.

A house having 24 windows, each measuring 1 ft. 6 in. 3 pts. wide, and 3 feet high, how much will they come to at 2s. 4d. per foot? *Ans.* £12 15s. 6d.

What is the worth of 16 squares of glass work, each measuring 4 ft. 10 in. long, 2 ft. 11 in. broad, at 18d. per foot? *Ans.* £16 18s. 4d.

A house has three rows of windows, 5 in a row; the height of the first is 5 ft. 6 in., the second, 5 ft. 3 in., and the third, 4 ft. 9 in.; the breadth is 2 ft. 6 in.; required the number of feet, and the expense of glazing at  $9\frac{1}{2}$  d. per square foot.

*Ans.* Content, 193 ft. 9 in.; expense, £7 13s.  $4\frac{1}{2}$  d.  $\frac{1}{2}$ .

### MASONS' WORK.

What is the price of a marble slab 5 ft. 7 in. long, and 1 ft. 10 in. broad, at 6s. per foot? *Ans.* £3 1s. 5d.

What will be the cost of a grave-stone, the length being 6 ft. 6 in., and the breadth 3 ft. 3 in., at 4s. 6d. per foot? *Ans.* £4 15s. 0½d.

What will it cost to pave a kitchen which measures 12 ft. 6 in. by 10 ft. 4 in., at 12s. 6d. per foot?

*Ans.* £80 14s. 7d.

How many square feet of paving in a court yard 68 ft. 4 in. by 60 ft. 6 in.; and what will it come to at 3½d. the square yard? *Ans.* 4134 ft. 2 in. the content; and the cost, £6 4s. 4¾d. ¾.

What is the value of a block of marble 12 ft. long, 10 ft. broad, and 7 ft. thick, at 14s. per solid foot? *Ans.* £588.

How many rods of mason-work in a wall 50½ ft. long, and 24½ ft. high; and what will it cost at 40s. per rod? *Ans.* Content, 3 r. 28 yd. 7½ in.; cost, £7 11s. 2¼d. ⅓.

### PAVING, PAINTERS', AND PLASTERERS', &c., WORK.

What will the paving of a court-yard come to at 4¾d. a yard, the length being 58 ft. 6 in., and breadth 54 ft. 9 in.? *Ans.* £7 0s. 10¼d.

What should a painter charge for painting a room, the walls of which were 8 ft. high, the room 18 ft. by 14 ft., ceiling included, at 2s. 8d. per yard? *Ans.* £11 6s. 4½d.

How many yards of plastering in the roof and walls of a room, 32 ft. 6 in. long, 16 ft. 6 in. broad, and 9 ft. 3 in. high, deducting a door 6 ft. 6 in. by 9 ft.; and what will be the content and cost, if charged at 4½d. the square yard? *Ans.* 158 yds. 1 ft. 3 in.; £2 19s. 3½d. ½.

What will a piece of wainscoting cost at 6s. 7½d. per yard, which measures 8 ft. 3 in. by 6 ft. 6 inches?

*Ans.* £1 19s. 5½d.

What shall I pay a person for painting the outside and inside of a large box 7 ft. 4 in. long, 4 ft. 8 in. wide, and 3 ft. 10 in. deep, at 8½d. a yard? *Ans.* £1 5s. 3d.

What will the paving of a court of a rectangular form cost at 3s. 2d. a yard; supposing the length 27 ft. 10 in., and the breadth 14 ft. 9 in.?

*Ans.* £7 4s. 5½d.

What will the paving of a street come to at 6d. per yard, the length of the street being 176½ feet, and the breadth 56½ feet?

*Ans.* £27 16s. 5½d.

What am I to pay a man for painting 3 doors at the charge of 9d. per square yard, the dimensions of each being 6 ft. 4 in. by 2 ft. 3 in.?

*Ans.* 7s. 1½d.

### FLOORING, PARTITIONING, ROOFING, &c.

How much will the cost be for roofing a house, one side of which measures 70 feet in depth, and 30 feet in width, at 10s. 8d. per square?

*Ans.* £22 8s.

How many square feet in the floor, roof, and walls of a house 50 feet long, 18 ft. broad, and 15 ft. high?

*Ans.* 3840 feet.

How many rods in a slated roof, the length of the ridge being 41 ft. 9 in., and in girt from eave to eave 46 ft. 6 in., allowing 9 inches additional on each side for the eaves; and what will be the content, and how much the expense of slating at 14s. 6d. the rod?

*Ans.* 6 r. 6 yd. 6 ft.; cost, £4 9s. 8½d.

How many square yards of flooring are in a house of 4 floors, the ground one included, 60 ft. by 30 ft. within the walls, deducting from each floor the vacancy for the stairs, 12 ft. 4 in. by 8 ft. 6 in.; required the content and value thereof at 3s. 6d. the square yard?

*Ans.* Content, 753 yds. 3 ft. 8 in.;  
value, £131 16s. 11½d.

How many squares are there in a partition measuring 361 ft. 6 in. long, and 26 ft. 6 in. high; and what will be the content and cost at £4 10s. per square?

*Ans.* 95 squares, 79 ft. 9 in.; and cost, £431 1s. 9½d.

How many deals 12 ft. 6 in. long, and 8½ inches broad, will floor a room 50 ft. by 16?

*Ans.* 90⅔.

A log of wood 12 ft. 6 in. long was sawn into 9 deals, each 1 ft. 9 in. broad; how many superficial feet did they contain, and what is the sawyer's wages at  $\frac{1}{4}$ d. per square foot?

*Ans.* 196 ft. 10 in. 6 pt.; and the sawyer's wages, 8s.  $2\frac{1}{4}$ d.  $\frac{3}{4}$ .

### MEASURING BY THE ROD.

Bricklayers are accustomed to measure their work at the rate of a brick and a half thick, and if the thickness of the wall be more or less, it must be reduced to that thickness or standard in the following manner:

Multiply the area of the wall by the number of half bricks in the thickness of the wall; the product divided by 3 gives the answer.

If the area of a wall be 4085 feet, and the thickness two bricks and a half, how many rods does it contain?

$$\frac{4085 \times 2\frac{1}{2} \times 2}{3} = \frac{20425}{3} = 6808.3333$$

Then,  $6808.3333 \div 272.25 = 25.007$  rods. *Ans.*

*Note.*— $272\frac{1}{4} = 272.25$  for the divisor, decimally.

What is the expense of a wall 64 ft. long, 20 ft. high, and 3 ft. thick, at 40s. a rod, supposing 36 sq. yds. is a rod, and 2 ft. thick, the standard for stone walling?

*Ans.* £11 17s.  $0\frac{1}{4}$ d.  $\frac{7}{8}$ .

How many square rods are there in a wall  $63\frac{1}{2}$  ft. long, 14 ft. 11 in. high, and  $2\frac{1}{2}$  bricks in thickness, if the rod be 272 sq. ft.?

*Ans.* 5 rods 218 ft. 8 in. 2 pt.

If a wall be 1000 feet long, and 6 feet high, and  $2\frac{1}{2}$  bricks thick, how many rods does it contain?

*Ans.* 36 r. 199 ft.

Find the number of rods contained in a school-room 25 ft. long, 10 ft. high, 15 ft. broad, the gable end of which measures 9 ft. 6 in. in height,  $1\frac{1}{2}$  brick thick; and tell what the same will come to at 3 guineas per rod of 272 sq. ft.?

*Ans.* £10 18s.  $3\frac{1}{4}$ d.



Suppose a house measures within the walls 64 ft. in length, and 36 ft. in width, and to be of a true pitch, what will it come to roofing, at 12s. 6d. the square?

*Ans.* Content, 34 sq. 56 ft.; and cost, £21 12s.

Admit the end of a house to be 28 ft. 10 in. in breadth, and the height of the eaves from the ground, 55 ft. 8 in., the gable (or triangular part above the end wall of 1 brick thick) to rise 42 courses of bricks, reckoning 4 courses to a foot, and that 20 feet high be  $2\frac{1}{2}$  bricks thick, 20 feet more 2 bricks thick, and the remaining part 15 ft. 8 in.  $1\frac{1}{2}$  brick thick, what will be the standard measure, and the cost at £5 16s. per rod of 272 sq. ft.?

*Ans.* 2282 ft. 7 in. 8 parts; cost, £48 13s. 5½d.

If I raise a brick wall 174 ft. 6 in. long, 6 ft. 11 in. high, and  $3\frac{1}{2}$  bricks thick, what must I charge for the same at £5 17s. per rod of 272 sq. ft.?

*Ans.* £60 11s. 4½d.

*To find the superficial content of board or plank.*

#### RULE.

Multiply the length by the breadth.

In a board 12 feet long, and  $8\frac{1}{2}$  inches thick, how many square feet?

<table style="margin-left: auto; margin-right: auto;"> <tr><td style="text-align: right;">ft.</td><td style="text-align: right;">in.</td></tr> <tr><td style="text-align: right;">12</td><td style="text-align: right;">0</td></tr> <tr><td style="text-align: right;">8</td><td style="text-align: right;">6</td></tr> <tr><td colspan="2"><hr/></td></tr> <tr><td style="text-align: right;">6</td><td style="text-align: right;">0</td></tr> <tr><td style="text-align: right;">8</td><td style="text-align: right;">0</td></tr> <tr><td colspan="2"><hr/></td></tr> <tr><td style="text-align: right;">8</td><td style="text-align: right;">0</td></tr> <tr><td colspan="2"><hr/></td></tr> </table>	ft.	in.	12	0	8	6	<hr/>		6	0	8	0	<hr/>		8	0	<hr/>		Or thus:—	<table style="margin-left: auto; margin-right: auto;"> <tr><td style="text-align: right;">ft.</td></tr> <tr><td style="text-align: right;">6 (<math>\frac{1}{2}</math>)</td></tr> <tr><td style="text-align: right;">12</td></tr> <tr><td colspan="2"><hr/></td></tr> <tr><td style="text-align: right;">2 (<math>\frac{1}{2}</math>)</td></tr> <tr><td style="text-align: right;">6</td></tr> <tr><td style="text-align: right;">2 (<math>\frac{1}{4}</math>)</td></tr> <tr><td style="text-align: right;">2</td></tr> <tr><td style="text-align: right;">0</td></tr> <tr><td style="text-align: right;">6</td></tr> <tr><td colspan="2"><hr/></td></tr> </table>	ft.	6 ( $\frac{1}{2}$ )	12	<hr/>		2 ( $\frac{1}{2}$ )	6	2 ( $\frac{1}{4}$ )	2	0	6	<hr/>	
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Required the area of a plank 14 in. broad, and 16 ft. 6 in. long?

*Ans.* 19 ft. 3 in.

In a deal  $10\frac{1}{2}$  feet long, and  $8\frac{1}{4}$  in. broad, how many sq. ft.?

*Ans.* 7 ft. 1 in. 3 pts.

In a deal 15 ft. 6 in. long, and 10 in. 6 pts. broad, how many square feet? *Ans.* 13 ft. 6 in. 9 pts.

*Note.*—If the two ends of a plank or board differ in breadth, add the two breadths, and multiply the length by half the sum.

How many square feet in a board 12 ft. 9 in. long, the breadth at one end being 15 inches, and at the other 10? *Ans.* 13 ft. 3 in. 4 pts. 6 th.

*To find the solid content of square or unequal sided timber or stone.*

**RULE.**

Multiply the length, breadth, and thickness together.

Required the solid content of a tree, 16 feet long, and 14 inches the side of the square.

ft.	in.		ft.	in.
16	0	Or thus:—	2 ( $\frac{1}{8}$ )	16 0
1	2			2 8
<hr/>				<hr/>
2	8 0		2 ( $\frac{1}{8}$ )	18 8
16	0			3 1 4
<hr/>				<hr/>
18	8 0		<i>Ans.</i>	21 9 4
1	2			<hr/>
<hr/>				
3	1 4 0			
18	8 0			
<hr/>				
<i>Ans.</i>	21 9 4 0			

Find the solid content of a tree, 14 ft. long, and 10½ in. the side of the square. *Ans.* 10 ft. 8 in. 7 pts. 6 th.

If a piece of timber be 18½ feet long, 14 inches broad, and 9 deep, what is the solid content thereof?

*Ans.* 16 ft. 2 in. 3 pts.

What is the solid content of a piece of timber or

stone, whose sides are 10 inches by 18, and the length 18 ft. ?

*Ans.* 22 ft. 6 in.

What is the solid content of a piece of timber 15 ft. 3 in. in length, breadth 15 inches, and depth  $4\frac{1}{4}$  inches ?

*Ans.* 7 ft. 1 in. 2 pt. 4 thirds 6 fourths.

*Note.*—The usual way to measure *round* timber is to gird the tree in the middle with a small cord, then  $\frac{1}{4}$  th of the girt is considered as the side of the square. *Tapering* timber is measured by girding it in two or more places, and dividing the sum of the girts by their number for the mean girt.\*

What is the solid content of a round tree 25 feet long, and girt in the middle 45 inches ?

*Ans.* 21 ft. 11 in. 8 s. 9 fths.

How much timber in a round tree 30 feet long, and the girt 42 inches ?

*Ans.* 22 ft. 11 in. 7 pts. 6 th.

How many solid feet in a round tree 28 ft. 6 in. long, and the girts 48 in., 42 in., and 36 in. ?

*Ans.* 21 ft. 9 in. 10 s. 1 th. 6 fths.

In a piece of tapering unequal sided timber 24 ft. 9 in. long, the base of the greater end being 34 inches by 20, and at the other end 17 inches by 10, how many solid feet ?

*Ans.* 65 ft. 8 in. 10 pts. 10 th. 6 fths.

*Note.*—Add the length and breadth of the bases separately; divide each of the sums by 2; then multiply the quotients together, and that product by the length.

How many square feet in the floor, roof, and walls of a house 40 feet long, 18 feet broad, and 15 feet high ?

*Ans.* 3180 feet.

What is the weight of a plank  $24\frac{1}{4}$  feet long, 2 broad, and  $1\frac{1}{4}$  thick, at 25 lb. the solid foot ?

*Ans.* 1531  $\frac{1}{4}$  lb.

\* All parts of a tree that are less than two feet in circumference are *not* considered timber.

Required the price of the same, viz.  $61\frac{1}{2}$  feet, at 14d. per foot, and the expense of carrying it at  $\frac{1}{2}$ d. per lb.

*Ans.* Price, £3 11s.  $5\frac{1}{2}$ d.; carriage, £3 3s.  $9\frac{1}{2}$ d.  $\frac{1}{2}$ .

### PLANK MEASURE.

*To find how many loads and feet of timber are in any quantity of timber.*

#### RULE.

If the thickness of the plank be	4 inches,	150	will be loads ;	3	
	3	200	and by	4	
	$2\frac{1}{2}$	240		$4\frac{8}{10}$	
	2	300		6	
	$1\frac{1}{2}$	400		8	
	1	600		12	
	$\frac{3}{4}$	800		16	
					solid feet.*

How many loads and feet of timber are in 7684 feet of 4 inch plank?

150 ) 7684 ( 51 loads  $11\frac{1}{2}$  ft. *Ans.*

$$\begin{array}{r}
 750 \\
 \hline
 184 \\
 150 \\
 \hline
 3 \ ) \ 34 \\
 \hline
 11\frac{1}{2} \text{ ft.} \\
 \hline
 \end{array}$$

In 7420 feet of 3 inch plank, how many loads and feet of timber?

*Ans.* 37 lds. 5 ft.

In 4150 feet of  $2\frac{1}{2}$  inch plank, how many loads, &c.?

*Ans.* 17 lds. 14 ft.

\* As 50 solid feet of square or hewn timber make a load, it is evident that the plank of 4 inches being only  $\frac{1}{4}$  part of a foot in thickness, the superficial content must be 3 times 50, or 150 feet, to be equal to a load; and so of the rest. And, for the same reason, the square feet of the 4 inch plank divided by 3, the 3 inch by 4, &c., will give solid feet.

How many feet long of plank  $2\frac{1}{2}$  inches, and 14 inches wide, will make a load?

$$12 \times 2.5 \times 14 = 420$$

$$50 \times 12 \times 12 \times 12 = 86400 \div 420 = 205.71 \text{ feet. } \textit{Ans.}$$

How many feet of  $3\frac{1}{2}$  inch plank, 15 inches wide, will make a load? *Ans. 137\frac{1}{2} ft.*

In 3180 feet of  $1\frac{1}{2}$  inch plank how many loads and feet of timber? *Ans. 7 lds. 47\frac{1}{2} ft.*

### MENTAL CALCULATIONS.

WHAT are 4 times 2 and the half of 12?

What is the square of 2 added to half a hundred?

What is the cube of 3, added to 5 score?

If I add  $\frac{3}{4}$ d. to 3 halfpence, how much is it?

Tell me the one-tenth part of a thousand?

What are 7 halfpence and 8 farthings?

What is the fourth part of a pound, of a crown, of a shilling, of a sixpence, of a groat?

If 2 birds cost  $4\frac{3}{4}$ d., and 2 tops  $2\frac{1}{2}$ d. each, what was the whole cost?

What are  $18\frac{1}{2}$  yards of calico worth at 2s. a yard?

Add  $1\frac{1}{4}$ d. to  $4\frac{1}{2}$ d. and three sixpences together.

What is one-fourth and three-fourths of a sovereign?

What is the amount in shillings of 4 pounds, 3 crowns, and 10 sixpences?

What will 100 yards of tape cost at  $\frac{3}{4}$ d. a yard?

How many farthings are equal to one shilling and sixpence?

Add  $\frac{3}{4}$ d. to a halfpenny, and 9 farthings more; what is that?

How many lbs. of meat are there in  $12\frac{1}{2}$  stones?

What are 9 times 9 and the half of 9?

What is the  $\frac{1}{8}$ th, the  $\frac{1}{4}$ th, the  $\frac{1}{16}$ th, and the  $\frac{1}{2}$ th of a pound?

How many twopences are there in one crown and ten sixpences?

What will  $4\frac{1}{2}$  dozen of wine come to at 3s. a bottle?

How many halfpence are there in 2 sixpences, 2 twopences, 8 groats, and 20 pence?

Tell me what  $23\frac{1}{2}$  yards of cloth would cost at 2s. 6d. a yard?

What is half a lb. of butter at 56s. a firkin?

If 14 yards of shoe-string cost 20d., how much will twice the measure come to, deducting  $3\frac{1}{2}$ d. spent in cakes and fruit?

What is the price of a bottle of wine, when a dozen cost 2 guineas and a crown?

Add up in your memory twice 20 and four times 65.

How much will 200 apples cost at  $\frac{1}{4}$ d. each?

How many halfpence are there in a guinea, and how many pence and farthings in £1?

If 2 kites cost 4d., what will a dozen cost?

Pay a man for 84 days' work at 3s. 6d. a day.

What are 24 farthings and as many three farthings?

What will  $90\frac{1}{2}$  pieces of broadcloth come to, at 5 guineas per piece?

How many half gallons are there in 3 hogsheads of beer?

What will 19 pears cost at  $1\frac{1}{2}$ d. each?

How many dozen bottles will a tun of wine fill?

How many dozen buttons make two gross?

How many quires of paper are there in 10 reams?

How many sheets of paper are there in 20 quires, each 24 sheets?

How many trusses are there in 20 tons of straw, each 1 load and a half, and 36 trusses to each load?

How many times will a hoop, which is a yard in circumference, turn in two miles?

If I buy a book for 3s. 6d., and sell it for 3 half-crowns, what do I gain?

If I spend 1s. 10½d. out of 4 crowns, what have I left?

What is the weekly expenditure of bread at 1s. 5d. a day?

How much will be due to a servant for a month's wages, at £10 a year?

What is fourteen times eighty?

Bought a knife for 1s. 9d., a quire of paper for 6d., a slate for 4½d., and spent in oranges and nuts, 7½d.; what is it altogether?

What is the value of 1 hundred weight of soap at 6½d. per lb.?

What will the consumption of a pint and a half of ale daily (at 6d. a pot) cost in one year, reckoning 365 days?

Add together  $\frac{1}{2}$  of 10s. to  $\frac{3}{4}$  of a pound.

If 1 cwt. cost half a crown, what will 240 cwt. cost?\*

**EXAMPLES IN EQUATION OF PAYMENTS, BARTER, PROFIT AND LOSS, PARTNERSHIP OR FELLOWSHIP (SINGLE AND DOUBLE), AND EXCHANGE.†**

## EQUATION OF PAYMENTS

A owes B £200, of which £40 is due at 3 months, £60 at 5 months, and £100 at 10 months; at what time may the whole be paid at once?

\* Here 2s. 6d. is the  $\frac{1}{2}$  of a £: so that,  $240 \div 8 = £30$  for the answer. And the same can be done with any other *fractional* part.

† These rules, with the exception of Exchange, are little known, and seldom used, in mercantile transactions.

£	mo.	£
40	× 3	= 120
60	× 5	= 300
100	× 10	= 1000
<hr/>		
200		) 1420 ( 7 $\frac{1}{5}$ mo. <i>Ans.</i>
		1400
<hr/>		
		$\frac{20}{100} = \frac{1}{5}$

Bought a quantity of goods to the value of £360, which it was agreed should be paid in the following manner: viz., £120 at 2 months, £200 at 4 months, and the rest of the money at 5 months; required the time of payment. *Ans.* 3 mo. 13 da.

### BARTER.

How much tea at 9s. a lb. can I have in barter for 4 cwt. 2 qr. of chocolate at 4s. per lb.?

		cwt. qr.
		4 2
		4
		<hr/>
		18
		28
		<hr/>
		144
		36
		<hr/>
	4 = $\frac{1}{4}$ )	504 lb. at 4s.
s.	lb.	<hr/>
As 9	: 1 ::	100 16
		20
		<hr/>
	9 )	2016
		<hr/>
	112 )	224 lb.
		<hr/>
		<i>Ans.</i> 2 cwt.





Bought 12 cwt. 2 qr. 13 lb. of sugar for £44 3s. 1½d.; at what rate must it be sold per lb. to gain £25 per cent.?  
*Ans.* 9½d.

Bought a hogshead of wine for £50 8s., and sold it for £63; what did I gain per cent.?  
*Ans.* £25.

If I gained £25 per cent. by wine which I bought at £50 8s. per hhd., what did I sell it at?  
*Ans.* £63 per hhd.

Bought sugar at 8½d. per lb.; at what rate must I sell it per lb. to gain £17 ½ per cent. by it?  
*Ans.* 10d.

If cheese be bought at £3 14s. 8d. per cwt., and sold at 10½d. per lb., what is gained per lb.?  
*Ans.* 2½d.

Sold 238 yards of muslin at 4s. 7d. per yard, by which I gained £30 per cent.; what did I gain in the whole?  
*Ans.* £16 7s. 3d.

If I buy tobacco at 10 guineas per cwt., at what rate must I retail it per lb. to gain £1 10s.?  
*Ans.* 2s. 1½d. ¾.

FELLOWSHIP (SINGLE).

DIVIDE £140 between three persons, so that their shares shall be to each other as 1, 2, and 3.

					£	s.	d.	
1	As 6	:	140	::	1	:	23 6 8	} <i>Answers.</i>
2		:	140	::	2	:	46 13 4	
3		:	140	::	3	:	70 0 0	
<hr/>								
6					140	0	0	<i>Proof.</i>
<hr/>								

Two merchants traded together, A put in £20, and B £40; they gained £50; what was each person's share?  
*Ans.* A's gain, £16 13s. 4d.; B's, £33 6s. 8d.

A bankrupt is indebted to B £250, to C £280, to D £300, and to E £102 10s.; his estate is worth only £600; how must it be divided amongst his creditors?

*Ans.* B, £160 17s. 1½d.  $\frac{11}{16}$ ; C, £180 3s. 2½d.  $\frac{7}{16}$ ; D, £193 0s. 7½d.  $\frac{11}{16}$ ; and E, £65 19s. 0½d.  $\frac{11}{16}$ .

A, B, and C join stocks in trade; their stocks amount to £200. A's gain was £3, B's £5, and C's £8; what was each man's stock?

*Ans.* A's, £37 10s.; B's, £62 10s.; C's, £100.

### FELLOWSHIP (DOUBLE).

D and E entered into partnership; D put in £40 for 3 months, E £75 for 4 months, and they gained £70; what was each man's share of the gain?

$$40 \times 3 = 120$$

$$\text{As } 420 : 70 :: 120 : £20 \text{ D's share.}$$

$$75 \times 4 = 300$$

$$420 : 70 :: 300 : £50 \text{ E's share.}$$

---


$$420$$


---

---


$$£70 \text{ Proof.}$$


---

Four graziers took a piece of pasture land for a year, for which they were to pay 35 guineas. F put in 27 oxen for 11 months; G, 18 oxen for 7 months; H, 12 oxen for 9 months; and I, 33 oxen for 4 months: required what each man must contribute towards the rent?

*Ans.* F, £16 19s. 3½d.  $\frac{2}{3}$ ; G, £6 19s. 8½d.  $\frac{1}{3}$ ; H, £5 19s. 8½d.  $\frac{1}{3}$ ; and I, £7 6s. 4½d.  $\frac{1}{3}$ .

### EXCHANGE.\*

EXCHANGE teaches us to find how much of the money

\* The author is indebted to "Tate's Arithmetic" for the sums in this rule, to which the pupil will refer for more complex examples, if such be deemed necessary.

of one country is of equal value to any given sum of the money of another.

HOLLAND.

If £1 of English money produce 35sh. 8 gr. in Holland, what will £300 produce?

$$\begin{array}{r}
 \begin{array}{rcccl}
 \text{£} & & \text{sh.} & \text{gr.} & \text{£} \\
 \text{If } 1 & : & 35 & 8 & :: 300 \\
 & & & 3 & \\
 \hline
 & & 107 & 0 & \\
 & & 100 & & \\
 \hline
 & & 10700 & \text{shillings.} & \\
 & & 3 & & \\
 \hline
 10 & ) & 32100 & & \\
 \hline
 \text{Ans. } 3210 & \text{florins.} & & & 
 \end{array}
 \end{array}$$

Shillings are reduced into florins by multiplying by 3, and dividing by 10; a shilling being 12 grotes, is therefore 12-40ths or 3 tenths of a florin.

The Table.

2 grotes .....	1 stiver.
12 grotes or 6 stivers .....	1 shilling.
20 stivers or 100 cents .....	1 florin.
2½ florins or 50 stivers .....	1 rix dollar.

The value of the florin is 20d. sterling, making the par of exchange between Holland and this country, 12 florins per pound sterling; 47½ florins are worth 100 French francs.

If 36sh. 6 gr. produce £1, what will 6000 fl. produce?  
*Ans.* £547 18s. 11d. sterling.

If 35sh. 4 gr. be worth £1, what will 3117 fl. 11sh. 4 gr. be worth?  
*Ans.* £294 7s. 6½d.

## ROTTERDAM.

How many current florins will £800 sterling produce at 11 flor. 12 stiv. per £?

flo.	stiv.
11	12
	10
<hr/>	
116	0
	80
<hr/>	
<i>Ans.</i> 9280 current florins.	

If 10 fl. 16 st. produce £1 sterling, what will 5380 florins produce?

*Ans.* £498 3s. nearly.

## HAMBURG.

If £1 produce 35 sh. 3 gr., what will £500 produce?

s.	g.
35	3
	12
<hr/>	
423 grotes.	
500	
<hr/>	
2 ) 211500 grotes.	
<hr/>	
16 ) 105750 stivers.	
<hr/>	
Marks 6609 6 stivers. <i>Ans.</i>	

If 36 sh. 2 gr. produce £1, what will 10000 marks produce?

*Ans.* £737 6s. 6½d. sterling.

If 35 sh. produce £1, what will 26797 marks produce?

*Ans.* £2041 13s. 6½d.

## FRANCE.

If £1 produce 24 liv. 6s., what will £571 produce?

$$\begin{array}{r}
 \text{£} \\
 571 \\
 24 \\
 \hline
 13704 \\
 5 \left( \frac{1}{4} \right) \quad 142 \ 15 \\
 1 \left( \frac{1}{4} \right) \quad 28 \ 11 \\
 \hline
 \text{Livres } 13875 \quad 6\text{s. } \textit{Ans.}
 \end{array}$$

*Table.*

12 deniers	.....	1 sou.
20 sous	.....	1 livre (franc).
20 livres or francs	.....	1 napoleon.

Accounts are now kept in *francs* and *centimes*,\* the value of the franc being 9½d. nearly.

Exchange £250 into francs, at 25·21 francs per pound sterling?  
*Ans.* 6302 fr. 50 cents.

If 24 liv. 11 sous produce £1, what will 1000 livres produce?  
*Ans.* £40 14s. 8d.

If £1 produce 24½ francs, what will £1000 produce?  
*Ans.* 24500 francs.

## SPAIN.

If 39½d. produce 8 reals of plate, what will £500 produce?

$$\begin{array}{r}
 \text{d.} \quad \text{r. of p.} \quad \text{£} \\
 \text{If } 39\frac{1}{2} : 8 :: 500 \\
 4 \quad \quad \quad 960 \\
 \hline
 157 \quad \quad \quad 480000 \\
 \hline
 157 \quad \quad \quad 8 \\
 \hline
 157 \quad \quad \quad 3840000
 \end{array}$$

Silver reals of plate 24558 20 maravedies.

\* 100 centimes make 1 franc.

## Table.

34 maravedies .....	1 real vellon.
8 reals .....	{ 1 piastre, or
	{ 1 dollar.

If  $39\frac{1}{2}$ d. produce 15 r. v. 2 mar., what will £100 produce?  
*Ans.* 9149 reals vellon, 22 mar.

If 8 reals are worth  $37\frac{1}{2}$ d., what are 76782 reals worth?  
*Ans.* £1509 12s. 11d.

If 15 r. v. 2 m. be worth  $38\frac{1}{2}$ d., what will 20000 reals vellon be worth?  
*Ans.* £212 7s. 3d.

## PORTUGAL.

If 63d. produce 1 milree, what will £1000 sterling produce?

$$\begin{array}{r}
 \text{£} \\
 1000 \\
 240 \\
 \hline
 63 \ ) \ 240000 \\
 \hline
 \text{Ans. } 3809 \text{ milrees } 524 \text{ rees.}
 \end{array}$$

## Table.

1000 rees ..... 1 milree.

If I remit to London 8000 milrees, 500 rees, exchange at 5s.  $2\frac{1}{2}$ d. per milree, what does it come to in sterling money?

	mil.	rees.		mil.	rees.
5s. ( $\frac{1}{4}$ )	8000	500	Or done thus:—	8000,500	
					62 $\frac{1}{2}$
2d. ( $\frac{1}{30}$ )	2000	125			
	66	671	12 )	498031,125	
$\frac{1}{2}$ d. ( $\frac{1}{60}$ )	8	334			
			2,0 )	4150,2—7	
<i>Ans.</i>	£2075	130 = 2s. 7d.			
			<i>Ans.</i>	£2075 2s. 7d.	

GIBRALTAR.

Exchange 2172 c. dollars 3 r. 12 q.; at  $36\frac{1}{4}$ d. each, into pounds sterling.

	c. d.	r.	q.			
30d. ( $\frac{1}{4}$ )	2172	3	12	at	2r. ( $\frac{1}{4}$ )	$36\frac{1}{4}$ d.
6d. ( $\frac{1}{4}$ )	271	10	0		1 ( $\frac{1}{4}$ )	$9\frac{1}{4}\cdot75$
$\frac{1}{4}$ d. ( $\frac{1}{4}$ )	54	6	0		8q. ( $\frac{1}{4}$ )	$4\frac{1}{4}\cdot375$
	6	15	9		4 ( $\frac{1}{4}$ )	$2\frac{1}{4}\cdot187$
		1	5	= val. of 3r. 12q.		$1\frac{1}{4}\cdot593$
<i>Ans.</i>	332	13s.	2d.			1s. $5\frac{1}{4}\cdot90$

Table.

16 quartos .....	1 real.
8 reals .....	1 current dollar.
12 reals .....	1 hard dollar.

If 38d. be worth 1 dollar, what will £670 be worth?

*Ans.* 4231 dollars 4 r. 10 q.

If 8 reals be worth  $37\frac{1}{4}$ d., what will 1801 hard dol.  $2\frac{1}{4}$  r. be worth?

*Ans.* £304 19s. 4d.

ITALY.

What number of dollars at Leghorn will £80 produce at  $51\frac{1}{4}$ d. per dollar?

d.	dol.	£
If $51\frac{1}{4}$ :	1 ::	80
4		960
205	205 )	76800

*Ans.*  $374\frac{1}{4}$  dollars.

Table.

12 deniers .....	1 sol.
20 sols .....	1 livre.
6 solidi .....	1 gross.
24 gross .....	1 ducat.



Value 6000 dol. at  $48\frac{1}{2}$ d. each.

s.	d.		dol.	
2	6	( $\frac{1}{8}$ )	6000	
1	3	( $\frac{1}{2}$ )	750	1 3
	3	( $\frac{1}{4}$ )	375	0 7 $\frac{1}{2}$
	$\frac{1}{4}$	( $\frac{1}{12}$ )	75	0 1 $\frac{1}{2}$
			6	5 0

*Ans.* £1206 7s. 0d.

If  $42\frac{1}{2}$ d. produce at Naples 1 ducat, what will £580 produce?

*Ans.* 3275  $\frac{1}{17}$  ducats.

If  $52\frac{1}{2}$  liv. produce £1, what will 3712 liv. 11 sol. 6 de. produce?

*Ans.* £73 10s. 4d.

#### GERMANY.

If 13 g. 5 k. produce at Vienna £1, what will 3874 g. 13 k. produce?

	g.	k.	£		g.	k.
If	13	5	: 1		3874	13
	60				60	

785                      785 ) 232453 kr.

*Ans.* £296 2s. 4 $\frac{1}{2}$ d.

#### Table.

4 pfennings .....	1 kreuzer.
60 kreuzers .....	1 florin or guilder.
90 kreuzers .....	1 rix dollar.

If 12 fl. 30 kr. produce £1, what will 4000 fl. produce?

*Ans.* £320 sterling.

If 188 florins produce 201 marks, what will 6580 flor. produce?

7035 marks.

Charges 70 do. (one per cent.)

6965 marks, Net proceeds at Hamburg.

## PETERSBURGH.

If 100 copecs produce  $30\frac{1}{2}$ d., what will 3267960 copecs produce?

$$\begin{array}{r} 3267960 \text{ copecs.} \\ 30\frac{1}{2} \\ \hline \end{array}$$

*Ans.*  $1008982\cdot65$  pence, or £4204 1s.  $10\frac{1}{2}$ d.

*Table.*

100 copecs ..... 1 rouble.

## SWEDEN AND DENMARK.

*Table.*

48 skillings ..... 1 rix dollar.

96 skillings ..... 1 rigsbank dollar.

In Sweden the silver dollar is valued at 53d. sterling, the par of exchange being about 12 rix dollars per pound sterling. The value of the Danish rigsbank dollar is  $1\frac{1}{2}$  marks banco, or about 2s.  $2\frac{1}{2}$ d. sterling, making the par of exchange about 9 rigsbank dollars, 13 skillings per pound sterling.

Exchange £500 sterling into rix dollars, at 11·2 rix dollars per pound sterling. *Ans.* 5600 rix dollars.

If 6 rigsbank d. 42 sk. produce at Copenhagen £1, what will 1171 rigsbank dollars 15 sk. produce?

*Ans.* £181 18s. 7d. sterling.

## IRELAND.

What Irish money must I receive in Ireland for a remittance of £800 sterling, exchange being at £10½ per cent.?

$$\begin{array}{r} \text{£} \qquad \qquad \text{£} \\ 10 \left( \frac{1}{10} \right) \quad 800 \text{ at } £10\frac{1}{2} \text{ per cent.} \\ \frac{1}{2} \left( \frac{1}{10} \right) \quad 80 \\ \qquad \qquad 4 \\ \hline \end{array}$$

*Ans.* £884 Irish money.

A gentleman at Dublin remits to London £600 Irish, exchange at £10½ per cent.; what sterling money will be received? *Ans.* £541 15s. 3d.

## AMERICA.

If 107½ dollars will buy a bill of 100 dollars, what will 8000 dollars buy? *Ans.* 7459 dol. 21 c.

*Note.*—100 cents = 1 dollar.

If 40 dol. produce £9, what will 7459 dol. produce? *Ans.* £1678 5s. 6d.

## INVOICES.\*

AN Invoice is a specification of goods, showing at one view their actual cost, with the charges thereon, and total amount thereof.

Invoice of twenty-two packages of printed calico, marked, &c.

	£	s.	d.	£	s.	d.
C.H. Twenty-two packages,						
M. each containing 100 pieces						
of 60 yards each, in all						
132000 yards, at 4½d.						
per yard . . . . .	24	75	0			
Discount 10 per cent. .	24	7	10			
				22	27	10
						0
CHARGES.						
Packing and other charges	15	18	0			
Insurance and policy . .	30	0	0			
Brokerage . . . . .	5	11	4			
				51	9	4
				£22	28	19
						4

\* The forms of business require that every invoice should be dated and signed at the foot by the parties making it. The letters E and O E are also frequently made use of to represent the words "Errors," and "Omissions excepted," as a sort of salvo against advantage being taken of any mistakes in the account.

## INVOICES.

111

## Invoice of refined sugar.

	cwt.	qr.	lb.	£	s.	d.	£	s.	d.
No. 1 to 6.	58	3	9 gross.						
	6	1	8 tare.						
	52	2	1	net at 80s,	210	0	9		
				6 hhds., &c.	2	8	0		
							212	8	9
No. 7 to 12.	52	2	16 gross.						
	5	3	22 tare.						
	46	2	22	net at 80s,	186	15	9		
				6 hhds., &c.	2	8	0		
							189	3	9
Amount of goods,				401	12	6			
Commission on £401 12s. 6d. at 2½ per cent.				10	0	10			
Insurance on £500* at 16							411	13	4
guineas per cent. and policy				85	5	0			
25s.									
Commission † on £500				2	10	0			
							87	15	0
Amount of the invoice,				£499	8	4			

## 6 BAGS OF DEMERARA COTTON.

	cwt.	qr.	lb.	lb.
Gross	16	1	5	= 1825
				45½ tare (1-40th).
				1779½ net at 21½d. = £159 8s. 3½d.

\* The Insurance is made on £500 to include the £411 13s. 4d., and the cost of the insurance.

† You charge Commission as a remuneration for your trouble in executing the order of your correspondent.

## AN EXAMPLE,

To illustrate the difference, or to show the *balance*, between debtor and creditor.

Mr. THOMAS CARLING in account with WILLIAM HENRY JOLLY.

1852.			1852.			INVOICES.		
DEBTOR.			CREDITOR.			£	s.	d.
Jan. 3	To sundries	. . . .	Jan. 19	By bill at sight	. . . .	. 18	0	0
" 15	To 25 yards of cloth	. 2 16 4	" 24	By brandy at 30s.	. . . .	. 15	16	6
Feb. 3	To bill returned	. . 18 0 0	Mar. 4	By sundries	. . . .	. 45	9	0
Mar. 16	To cash lent	. . . 35 5 0	Apr. 27	By cash	. . . .	. 50	10	0
Apr. 4	To 10 gal. of rum at 15s.	7 10 0		By balance	. . . .	. 6	12	8
" 10	To teas	. . . . 37 19 6						
" 19	To muslin	. . . . 5 9 0						
May 2	To sundries	. . . . 24 11 10						
						<hr/>		
						£186 8 2		
						<hr/>		

Account Sales of a bale of Italian thrown silk, marked and numbered as in the margin, received by the Mary, from Calais, and sold by order, and for the account of Marietti and Co., of Milan, at 6 months' credit.

		£	s.	d.	£	s.	d.
D. & D.	One bale of thrown						
22	silk, weight 248 lb.						
	8 tare.						
	<u>240</u>				360	0	0
	<b>CHARGES.</b>						
	Freight . . . . .	1	2	0			
	Duty 240 lb. at 5s. and						
	Entry, 6s. 6d. . . .	60	6	6			
	Scavage $\frac{1}{2}$ d. per lb. . .	0	10	0			
	Landing charges, ware-						
	house rent, small						
	charges, and Fire In-						
	surance . . . . .	2	0	0			
		63	18	6			
	Marine Insurance and						
	policy £400, at 7s. 6d.						
	per cent. . . . .	1	10	0			
		65	8	6			
	Interest 7 months, at 5						
	per cent. . . . .	1	17	11			
	Brokerage on £360, at						
	$\frac{1}{4}$ th per cent. . . .	2	5	0			
	Commission . . . . .	7	4	0			
	<i>Del Credere</i> , do. do. . .	7	4	0			
					83	19	5

Net proceeds—Value, 22 Feb. 1852, £276 0 7

London, 1st January, 1852.

Invoice of 100 Bales of Cotton, shipped on board the  
Eliza, Dempster, for Cadiz, by order and on account  
of Messrs. Lopez and Co., of Lisbon.

## 100 BALES OF COTTON.

		cwt.	qrs.	lb.	£	s.	d.
L. & Co. 1 at 100.	Weight gross . . .	360	0	0			
	draft, 2 lbs. . .	3	2	8			
		<hr/>					
	Ropes . . .	2	0	6			
		<hr/>					
	Tare . . .	19	3	4			
		<hr/>					
	Net, 334	2	10				
	Or, 37474 lbs. at 8d.				1249	2	8
	CHARGES.				£	s.	d.
	Bond, Dock, and Town						
	dues and entry . . .	4	1	0			
	Cartage and Porterage . .	4	8	0			
	Bills of Lading and petty						
	charges . . . . .	0	8	6			
	Brokerage $\frac{1}{2}$ per cent. . .	6	5	0	15	2	6
					<hr/>		
					1264	5	2
	Commission 2 per cent.				25	5	0
					<hr/>		
					£1289	10	2
					<hr/>		

Liverpool, 18th January, 1852.

Millard & Co.

## BOOK DEBTS, AND BILLS OF PARCELS.\*

Paternoster Row, Feb. 27th, 1852.

Mr. J. Scott,

Bought of W. Richards.

	£	s.	d.
1 James on the Collects . . . . .	5	0	
2 Carpenter on the Psalms . . . . .	4	0	
2 do. on the Church Prayers . . . . .	5	0	
2 do. Christian's Manual . . . . .	4	0	
6 do. Scholar's Spelling Assistant . . . . .	9	0	
2 Testaments . . . . .	3	6	
1 Large Bible, half-bound . . . . .	9	0	
6 Common Prayers . . . . .	12	0	
2 Quires of post paper . . . . .	1	10	
2 do. large foolscap . . . . .	3	4	
Binding Gibbon's Rome in calf, elegant . . . . .	1	10	6
Sundry Magazines, Pamphlets, &c. . . . .	8	10	½

£

Mrs. Canning, Dr.

To Elizabeth Wheeler.

1852.		£	s.	d.
Jan. 1	1 lb. butter . . . . .	1	1	
2	2 lb. cheese . . . . .	1	8½	
5	6 eggs . . . . .	0	9	
21	1 Dutch cheese . . . . .	1	9½	
Feb. 6	2 lb. bacon . . . . .	1	3	
8	Sand and salt . . . . .	0	3½	
10	Vinegar, pepper, &c. . . . .	1	9	
Mar. 3	Butter . . . . .	1	0	
7	2 oz. of tea . . . . .	0	9	

£

\* After having worked these bills, the tutor will keep a private memorandum of the amount of each, so that the pupil may be left to exercise his own skill and industry, and not be led by idleness or deception to copy off what he has to do.



Henry Bigley, Esq., Dr.

To Thomas James Rayner.

1852.			d.	£	s.	d.
Jan. 2	Beef and mutton	. 14½ lb.	at 9			
4	do.	. . . 12½	„ 8			
12	Beef steaks	. . . 3	„ 10½			
17	Veal	. . . . . 10½	„ 9½			
Feb. 6	Beef and mutton	. 15½	„ 8			
17	Pork	. . . . . 9	„ 8½			
				£		

London, 4th Jan. 1852.

Mr. Leeds,

Bought of John Gray.

			s.	d.	£	s.	d.
Irish cloth	. . . 16 yds.	at 3	6	per yard.			
Cambric muslin	. 24 „	3	8	„			
Broad cloth	. . 42 „	13	6	„			
Drugget	. . . 18 „	3	4	„			
Brown Holland	. 15 „	1	6	„			
Diaper	. . . . 56 „	2	7½	„			
					£		

Cheapside, 24th Jan., 1852.

Mr. Jarvis,

Bought of Richard Carter.

			s.	d.	£	s.	d.
Cotton hose	. . . . 13 pairs	at 2	6				
Worsted do.	. . . . 26 „	1	3½				
White silk do.	. . . . 12 „	5	6				
Black do.	. . . . 12 „	6	6				
Gentlemen's half hose	. 17 „	1	10½				
Kid gloves	. . . . 7 „	1	6				
					£		

Whitechapel, February 4, 1852

Mr. H. C. Carpenter,

Bought of James Wood.

		s.	d.	£	s.	d.
Veal cut.ets. . . . .	4½ lb. at	11	½			
Leg of lamb . . . . .	6½ „	11	½			
Leg of mutton . . . . .	9½ „	9				
Ribs of beef . . . . .	17½ „	10	½			
Pork chops . . . . .	2½ „	9	½			
Half a calf's head . . . . .				0	2	6
				£		

King William Street, Feb. 19th, 1852.

Mr. Jeffery,

Bought of Ridgway and Co.

		s.	d.	£	s.	d.
Hyson tea . . . . .	7 lb. at	7	9			
Bohea ditto . . . . .	14 „	5	2			
Coffee . . . . .	12½ „	2	6			
Ditto . . . . .	2½ „	2	0			
Lump Sugar . . . . .	22½ „	0	10½			
Moist ditto . . . . .	14 „	0	7			
				£		

Cheapside, March 4th, 1852.

Mr. Charles Chester,

Bought of Thomas Hyder.

		s.	d.	£	s.	d.
Port wine . . . . .	26½ doz. at	38	6 per doz.			
Madeira . . . . .	15 „	42	6 „			
Sherry . . . . .	19½ „	36	0 „			
Brandy . . . . .	6 gal. at	28	6 per gal.			
Rum . . . . .	3½ „	16	6 „			
Gin . . . . .	10 „	11	0 „			

Discount 2½ per cent. . . . .

£

Victoria Street, March 17th, 1852.

James Laird, Esq.,

Bought of Samuel Finch.

	oz.	dwt.	gr.	s.	d.	£	s.	d.
A silver waiter . . .	20	2	0	at	5 10	per oz.		
A do. teapot & stand	11	3	10	„	6	6	„	
A do. tankard . . .	31	4	12	„	7	4	„	
$\frac{1}{2}$ doz. silver forks .	12	2	4	„	6	1 $\frac{1}{2}$	„	
1 $\frac{1}{2}$ d. silv. tab. spoons	40	2	8	„	5	10	„	

Cr. by cash in part, 10 10 0

Bal. £

Chelmsford, April 4th, 1852.

Mr. William Pratt,

Bought of John Hurley.

		s.	d.	£	s.	d.
Barley . . .	121 qrs.	at	34 6	per qr.		
Wheat . . .	65	„	60 6	„		
Oats . . .	78	„	24 0	„		
Rye . . .	116	„	30 6	„		
White Peas . .	421 bu.	at	38 0	per bu.		
Beans . . .	43 $\frac{1}{2}$	„	6 4	„		

£

Greenwich, May 3rd, 1852.

Mr. Brett,

Bought of Richard Thompson.

	cwt.	qr.	lb.	lb.	s.	d.	£	s.	d.
Soap . . .	11	3	7	tare	14	at	50	6	
Sugar . . .	65	2	17	„	16	„	48	0	
Rice . . .	51	0	14	„	8	„	30	6	
Cartarge, Wharfage, &c. . .							2	10	6

£

Manchester, Aug. 16th, 1852.

Mr. B. Millard,

Bought of Joseph Wm. Longley.

		s.	d.	£	s.	d.
19½ yds. of Irish linen . . . . .	at	2	4	per yd.		
24½ pieces of do. . . . .		45	6	per p.		
16½ doz. pr. of hose . . . . .		1	8	per pr.		
13½ score of men's night caps . . . . .		10½		each		
36½ pieces of cambric . . . . .		48	0	per p.		

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 £
 

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London, Sept. 3, 1852.

Messrs. Willett and Co.

Bought of Simon Turner.

4 hhds. of sugar, viz. :

	cwt.	qr.	lb.	
No. 1	16	1	4	Tare, 18lb. per cwt.
2	18	8	16	Draft, 2 cwt.
3	15	0	0	
4	15	3	10	

---

 £ s. d.

Net, 53 cwt. 1qr. 18lb. at 36s. 6d.

2 hhds. of Delti,

	cwt.	qr.	lb.
No. 1	15	3	21
2	16	0	14

Tare, 1200 lb. in the whole.

Draft, 800 lb.

Net 2091 lb. at 34s. 8d. . . . .

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 £
 

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Brentwood, Sept. 5th, 1852.

Mrs. Corder,

Bought of Edward Forrest.

		s.	d.	£	s.	d.
Muslin . . . . .	12½ yds. at	2	7½			
Cambric . . . . .	6½ „	1	9			
Silk . . . . .	14½ „	2	6½			
Brocade . . . . .	4½ „	3	2½			
Print . . . . .	6½ „	1	6			

£

Sept. 12th, 1852.

Received of Mrs. Corder, pounds, s. d., as per  
bill EDWARD FORREST.

£

Southwark, Oct. 9th, 1852.

Messrs. Dale and Co.

Bought of Frederick Thomson.

		s.	d.	£	s.	d.
1164½ pieces of cloth . . . . .	at 56	6	per piece			
146½ do. each 24 yds. „	2	4	per yd.			
3000½ do. . . . .	29	3	per p.			

Discount at 2½ per cent. . . . .

£

Newgate-street, March 15th, 1852.

Mrs. Whitwell,

Bought of Edward Price.

		s.	d.	£	s.	d.
Calico—120 pieces, each 47½ yds. at		8	½			
Bombazine . . . . .	52 „	3	6			
Book Muslin . . . . .	8 „	1	4			
Sheeting . . . . .	56½ „	1	10½			
Flannel . . . . .	20 „	1	6			
Lawn . . . . .	10 „	2	9			

£

Woolwich, Oct. 4, 1852.

Mr. James Sanderson,

Bought of J. and E. Robinson.

	s.	d.	£	s.	d.
14½ stone of meat . . at	0	7			per lb.
12¾ ditto . .	0	6½			„
8½ ditto . .	0	10½			„
120 lb. mutton . . .	4	6			per stone
176½ lb. lamb and beef	5	8			„

Discount allowed for immediate payment .

£

## RECEIPTS, PROMISSORY NOTES, &c.

RECEIVED, January 2nd, 1852, of Mr. Thomas Crane, ten pounds, five shillings, as per bill delivered.

£10 5s.

WILLIAM JORDAN.

Received, Jan. 4th, 1852, of Mr. James Freeman, five pounds for a quarter's rent due Christmas last.

£5.

MARY WILSON.

Received, Jan. 21st, 1852, of Mrs. Wool, thirteen pounds, nine shillings, and sixpence, for haberdashery, &c., as per bill.

£13 9s. 6d.

JOHN EVANS.

Received, Feb. 10th, 1852, of Samuel Meek, Esq., fifty pounds on account.

£50.

EDMUND BURKE.

Received, May 7th, 1852, of Mr. Lowndes, ten pounds, for my quarter's salary, due this day.

£10.

JOHN MELLISH.

Received, April 5th, 1852, of Mr. George Truman, eight pounds, for a year's wages, due at Lady-day last.

£8.

MARY CURTIS.

Received, May 16th, 1852, of Mr. William Williams, forty guineas for a bay mare, warranted sound in wind and limb, and not given to any vice whatever.

£42.

CHARLES LODGE.

Received, May 12th, 1852, of Mr. Noble, jun., nineteen pounds, 3s. 11½d. in part of a bill delivered to the 3rd inst.

JAMES Groat.

£19 3s. 11½d.

Received, May 20th, 1852, of Charles Phillips, Esq., one hundred and ten pounds, eight shillings, and tenpence, for self and partner, as per account herewith.

£110 8s. 10d.

FREDERICK MASON.

Received, January 8th, 1852, of Mr. Thomas Corton, eleven pounds, 4s. 6d., for bricklayer's work done, as per bill.

JAMES ROGERS.

£11 4s. 6d.

#### FORM OF AN ENGLISH BILL.\*

£140 10s. 6d.

London, the 2nd Feb., 1852.

Two months after date pay to me, or my order, one hundred and forty pounds, ten shillings, and sixpence, for value received.

WILLIAM CASHMAN

To Messrs. Boyd and Co.,  
Gravesend.

#### FORM OF A PROMISSORY NOTE.

£140 10s. 6d.

Gravesend, the 2nd Feb., 1852.

Two months after date we promise to pay to Mr. William Cashman, or order, one hundred and forty pounds, ten shillings, and sixpence, for value received.

WILSON AND Co.

Payable at Coutts and Co.,  
London.

\* The difference between a *bill* and a *promissory note* is this:—a *bill* requires the acceptance of the drawer (which is given by writing his name on it, called *endorsing*) before it becomes of any value; a *promissory note*, on the contrary, is binding the moment it is made and delivered, no acceptance, from the very form of the security, being at all necessary.

## A TRADESMAN'S ORDER FOR GOODS TO BE SENT.

Norwich, 18th March, 1852.

SIR,

I will thank you to forward, per railway, the following articles :—

	cwt.	qr.	lb.		
Loaf sugar . .	2	0	0	at	90s.
Moist do. . .	1	2	0	„	64s.
Green tea . .	0	0	14	„	7s. 6d.
Black do. . .	0	0	7	„	5s. 4d.
Rice . . . .	1	0	0	„	7s.

Your attention will much oblige, Sir,

Yours obediently,

JAMES PRICE.

## THE ANSWER.

London, 23rd March, 1852.

SIR,

I have forwarded, per railway, the whole of your order, with the exception of the rice, owing to my not having any which I can at present recommend; and am, Sir,

Your obliged

and obedient servant,

JOHN TRUMAN.

## ARITHMETICAL QUESTIONS,

FOR

WEEKLY OR OCCASIONAL EXAMINATION.\*

3½ butts of beer, at 2d. a pint.

3½ hhds. of ale, at 4d. a pint.

\* The Author has adopted this plan successfully, varying it now and then with a bill of parcels, or an invoice, &c.



119 days' wages, at 2 guineas a week.

If I spend  $4\frac{1}{2}$ d. a day, what will that be in 100 weeks' time?

Multiply £41 10s. 6d. by  $4\frac{1}{2}$ .

Divide £100 and 3 crowns by  $12\frac{1}{2}$ .

---

2 pints of ale cost me 8d., what should I pay for 3 gal. 2 qts. 1 pint?

8 bottles of port wine cost me 32s. 6d., what am I to pay for  $18\frac{1}{2}$  dozen?

I have 13s. 6d. a week from my employer, what is that a year?

12 cwt. 3 qr. 10 lb. of cheese, at  $7\frac{1}{2}$ d. per lb.

$18\frac{1}{2}$  tubs of butter, each weighing  $37\frac{3}{4}$  lb., at  $7\frac{3}{4}$ d. per lb.

---

Gross weight 16 cwt. 17 lb., tare 18 lb. per cwt., draft 110 lb., how many gallons of oil, and value at 26s. 6d. per gallon?

What are 19 bar. 2 fir. 3 gal. of beer worth, at 16d. a gallon?

Divide 119 tons 13 cwt. 2 qr. 11 lb. 2 oz. by 23.

If I have a yearly income of £100, what may I allow myself to spend every day?

Divide £100 by  $10\frac{1}{2}$ .

---

$19\frac{1}{2}$  doz. of port, at 2s. 3d. a bottle.

100 bottles of Madeira, at 64s. per doz.

15 quarts of rum, at 14s. 6d. a gallon.

16 quarts of brandy, at 30s. a gallon.

118 pints of ale, at 8d. a quart.

---

1000 barrels of beer, at 86s. 6d. per hhd.

10000 sacks of flour, at 4s. 2d. a bushel.

119 days' service, at 50 guineas per annum.

What is the  $7\frac{2}{3}$  of a million of guineas?

Multiply 1000 crowns, and as many groats, by  $13\frac{1}{2}$ .

---

1008 gallons of wine, at £130 per pipe.

1500 bottles of Madeira, at 84s. per doz.

1162 trusses of hay, at 58s. per load.

Multiply  $25\frac{1}{2}$  guineas and a 6d., by 23.

---

Divide 19426 tons 12 cwt. 2 qr. 10 lb. 13 oz., by 362.

Multiply 21 cwt. 3 qr. 15 lb. 2 oz., by  $4\frac{1}{3}$ .

Divide 20000 half-guineas, by 31.

Pay a man his wages, viz., 15 weeks, 2 days, at 2s. 6d. a day.

---

What are  $4\frac{1}{2}$  hhds. of wine worth, if I gave 2s. 3d. for a bottle which contained  $1\frac{1}{2}$  pint?

What are one thousand bottles of wine worth, at 50s. a dozen?

What must I pay a man for 18 weeks, 3 days' wages, at £20 a year?

Divide £4645 10s., by  $2\frac{1}{3}$ .

Multiply £300 15s. 6d., by 20.

---

If  $3\frac{1}{2}$  quarts of ale cost 1s. 9d., what will a barrel and 2 pints come to?

Value  $2465\frac{1}{2}$  pieces of blue cloth, at 50s. 6d. per piece.

If I lend you £200 and 3 crowns for  $8\frac{1}{2}$  months, at 50s. per cent. per annum, what will be the interest?

Pay a workman for 18 weeks' employment, at 3s. 8d. a day.

	£	s.	d.
17 tons 4 cwt. of potatoes, at 50s. per cwt.			
6½ barrels of ale, at 4d. a pint . . . . .			
2 hogsheads of ale, at 8d. per quart . . .			
3 tubs of pork, each 48 lb. at 4½d. a lb. .			
20 pieces of sheeting, each 36½ yds. at			
1s. 1½d. per yard . . . . .			

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17 tons 2½ cwt. of potatoes, at 5 lb. for three half-pence.

31½ puncheons of rum, at 2s. 3d. a quart.

192½ gallons of brandy, at 2s. 10d. a pint.

If I save 4½d. a week, what shall I have in 19 weeks, 3 days?

1½ ton of potatoes, at 3s. 2d. per cwt.

18 weeks' wages at half-a-crown a day.

If I spend £50 a year, what do I spend a day?

Divide £249 and a crown, by 17½ and 2½.

What is ¼th of a guinea, ⅔ths of a pound, and ⅔ths of a crown?

Reduce 182409 groats to sixpences, and then to guineas.

Divide 104 firkins of butter into 17 equal quantities.

Divide 42 tons 3 hhds. 18 gal. 3 qts. of wine, by 24 short division, and the same, long division.

How many tons of mangel wurzel are there in an acre, each root weighing 12 lb., and each root 2 feet apart?

1 hhd. 10 gal. of British wine . . . . .	at	12	6 per gal.
2½ barrels of beer . . . . .	"	2	6 "
1½ hhd. of ale . . . . .	"	0	4 per qt.
120 gallons of gin . . . . .	"	10	8 per gal.
1800 bottles . . . . .	"	1	9 per doz.

18 hhds. 27 gal. of beer . . . . .	at	56	0	per hhd.
24 gal. 3 qts. of ale. . . . .	"	2	3	per gal.
15 dozen of port . . . . .	"	2	6	per bot.
12½ do. of sherry . . . . .	"	3	0	"
<hr/>				
19½ dozen of port . . . . .	at	2	6	per bot.
30½ score of sherry . . . . .	"	3	2	"
1 pipe Madeira . . . . .	"	4	0	per gal.
1 do. Bucellas . . . . .	"	2	6	"
3 do. 18½ gal. of British spirits . .	"	1	8	"

ARITHMETICAL TABLES.

MULTIPLICATION AND DIVISION TABLE.

Twice 1 are 2	3 times 1 are 3	4 times 1 are 4
2 4	2 6	2 8
3 6	3 9	3 12
4 8	4 12	4 16
5 10	5 15	5 20
6 12	6 18	6 24
7 14	7 21	7 28
8 16	8 24	8 32
9 18	9 27	9 36
10 20	10 30	10 40
11 22	11 33	11 44
12 24	12 36	12 48
5 times 1 are 5	6 times 1 are 6	7 times 1 are 7
2 10	2 12	2 14
3 15	3 18	3 21
4 20	4 24	4 28
5 25	5 30	5 35
6 30	6 36	6 42
7 35	7 42	7 49
8 40	8 48	8 56
9 45	9 54	9 63
10 50	10 60	10 70
11 55	11 66	11 77
12 60	12 72	12 84

## ARITHMETICAL TABLES.

8 times 1 are 8	9 times 1 are 9	10 times 1 are 10
2 16	2 18	2 20
3 24	3 27	3 30
4 32	4 36	4 40
5 40	5 45	5 50
6 48	6 54	6 60
7 56	7 63	7 70
8 64	8 72	8 80
9 72	9 81	9 90
10 80	10 90	10 100
11 88	11 99	11 110
12 96	12 108	12 120

11 times 1 are 11	12 times 1 are 12
2 22	2 24
3 33	3 36
4 44	4 48
5 55	5 60
6 66	6 72
7 77	7 84
8 88	8 96
9 99	9 108
10 110	10 120
11 121	11 132
12 132	12 144

## MONEY TABLES.

Shillings.			Pence.		
s.	£	s.	d.	s.	d.
20 make	1	0	20 make	1	8
30	1	10	30	2	6
40	2	0	40	3	4
50	2	10	50	4	2
60	3	0	60	5	0
70	3	10	70	5	10
80	4	0	80	6	8
90	4	10	90	7	6
100	5	0	100	8	4
110	5	10	110	9	2
120	6	0	120	10	0
			12 make	1	0
			24	2	0
			36	3	0
			48	4	0
			60	5	0
			72	6	0
			84	7	0
			96	8	0
			108	9	0
			120	10	0
			132	11	0

## TABLES OF WEIGHTS AND MEASURES.

## TROY WEIGHT.

24 grains . . . . .	1 pennyweight	<i>grs. dwt.</i>
20 pennyweights . . . . .	1 ounce	<i>oz.</i>
12 ounces . . . . .	1 pound	<i>lb.</i>

Gold, silver, and some liquids, are weighed by this weight.

## AVOIRDUPOIS WEIGHT.

16 drams . . . . .	1 ounce	<i>drs. oz.</i>
16 ounces . . . . .	1 pound	<i>lb.</i>
28 pounds . . . . .	1 quarter	<i>qr.</i>
4 quarters, or 112 pounds . . . . .	1 hundred weight	<i>cwt.</i>
20 hundred weight . . . . .	1 ton	<i>t.</i>
8 pounds of meat . . . . .	1 stone	<i>st.</i>

Bread, meat, grocery, and goods in general, and all metals, except gold and silver, are weighed according to this table.

## APOTHECARIES' WEIGHT.

20 grains . . . . .	1 scruple	<i>gr. ℥</i>
3 scruples . . . . .	1 drachm	<i>3</i>
8 drachms . . . . .	1 ounce	<i>℥</i>
12 ounces . . . . .	1 pound	<i>lb.</i>

This table is used by physicians, apothecaries, and druggists.—Apothecaries, in making up their medicines, adopt this weight, and sell drugs by avoirdupois weight.

## CLOTH MEASURE.

2½ inches . . . . .	1 nail	<i>in. na.</i>
4 nails . . . . .	1 quarter	<i>qr.</i>
4 quarters . . . . .	1 yard	<i>yd.</i>
3 quarters . . . . .	1 ell Flemish	<i>ell Fl.</i>
5 quarters . . . . .	1 ell English	<i>ell Eng.</i>
6 quarters . . . . .	1 ell French	<i>ell Fr.</i>

The above measures are used by linen and woollen drapers, in cutting out and measuring their goods, when either bought or sold.

## LAND OR SUPERFICIAL MEASURE.

144 inches . . . . .	1 foot	<i>ft.</i>
9 feet . . . . .	1 yard	<i>yd.</i>
30½ yards . . . . .	1 pole	<i>po.</i>
40 poles . . . . .	1 rood	<i>ro.</i>
4 roods . . . . .	1 acre	<i>ac.</i>

10 chains, or 4840 yards, or 100000 links, are an acre.

*Also,*

640 acres, make . . . . .	1 square mile.
100 feet „ . . . . .	1 square of flooring.
272½ feet „ . . . . .	1 rod of walling.

## LINEAL MEASURE.

3 barleycorns . . . . .	1 inch	<i>in.</i>
12 inches . . . . .	1 foot	<i>ft.</i>
3 feet . . . . .	1 yard	<i>yd.</i>
5½ yards . . . . .	1 pole or perch	<i>po. or per.</i>
40 poles or perches . . . . .	1 furlong	<i>fur.</i>
8 furlongs . . . . .	1 mile	<i>mi.</i>
3 miles . . . . .	1 league	<i>leag.</i>

This measure is used to measure distances of places, or any thing else where length only is required.

## CUBIC OR SOLID MEASURE.

1728 solid inches . . . . .	1 cubic foot	<i>c. ft.</i>
27 solid feet . . . . .	1 cubic yard	<i>c. yd.</i>
40 feet of round timber, or }	1 ton or load	<i>t. ld.</i>
50 feet of hewn timber }		
42 cubic feet . . . . .	1 ton of shipping.	

## ALE AND BEER MEASURE.

2 pints . . . . .	1 quart	<i>qt.</i>
4 quarts . . . . .	1 gallon	<i>gal.</i>
9 gallons . . . . .	1 firkin	<i>fk.</i>
2 firkins . . . . .	1 kilderkin	<i>kild.</i>
2 kilderkins . . . . .	1 barrel	<i>bar.</i>
1½ barrel, or 54 gallons . . . . .	1 hogshead	<i>hhd.</i>
2 hogsheads . . . . .	1 pipe or butt	<i>pi.</i>

## WINE MEASURE.

2	quarterns or gills . . . . .	1	half-pint	<i>qtn.</i>
2	half-pints, or 4 gills . . . . .	1	pint	<i>pt.</i>
2	pints . . . . .	1	quart	<i>qt.</i>
4	quarts . . . . .	1	gallon	<i>gal.</i>
42	gallons . . . . .	1	tierce	<i>t.</i>
63	gallons . . . . .	1	hogshead	<i>hhd.</i>
84	gallons . . . . .	1	puncheon	<i>pun.</i>
1½	puncheon or 2 hhds. . . . .	1	pipe*	<i>pi.</i>
2	pipes, or 252 gallons . . . . .	1	tun	<i>tu.</i>

## DRY MEASURE.

2	pints . . . . .	1	quart	<i>qt.</i>
4	quarts . . . . .	1	gallon	<i>gal.</i>
2	gallons . . . . .	1	peck	<i>pk.</i>
4	pecks . . . . .	1	bushel	<i>bu.</i>
8	bushels . . . . .	1	quarter of grain	<i>qr.</i>
5	bushels . . . . .	1	sack of flour	<i>sk.</i>
5	quarters . . . . .	1	load of wheat	
2	weys, or 10 quarters . . . . .	1	last	<i>l.</i>

## COAL WEIGHT.

112	lbs . . . . .	1	cwt.	
224	lbs. . . . .	1	sack	<i>sk.</i>
20	cwt., or 10 sacks . . . . .	1	ton	<i>to.</i>

## MEAL WEIGHT.

1	quartern or quarter of a peck of } barley meal weighs	3	lbs.
1	peck ditto . . . . .	12	"
1	quartern or quarter peck of flour . . . . .	3½	"
1	peck of ditto . . . . .	14	"
1	bushel of ditto . . . . .	57	"
1	sack of ditto . . . . .	2½	cwt.

\* The pipe here specified is 2 hogsheads, or 126 gallons; but a pipe of foreign wines varies from 110 to 140 gallons.

NOTE.—The imperial gallon, with its divisions, is the only legal liquid and dry measure. An imperial gallon of water weighs 10 lb. Avoirdupois, and contains 277·274 cubic inches.



## HAY AND STRAW WEIGHT.

56 lbs. of old hay	}	. . . . . 1 truss
60 lbs. of new ditto		
36 lbs. of straw		
36 trusses . . . . .		1 load
1½ load . . . . .		1 ton

## WOOL WEIGHT.

7 pounds . . . . .	1 clove	<i>cl.</i>
2 cloves . . . . .	1 stone	<i>st.</i>
14 pounds . . . . .	1 stone	
2 stones . . . . .	1 tod	<i>td.</i>
6½ tods . . . . .	1 wey	<i>wy.</i>
2 weys . . . . .	1 sack	<i>sk.</i>
12 sacks . . . . .	1 last	<i>lt.</i>
20 pounds . . . . .	1 score	
12 score or 240 pounds . . . . .	1 pack	

## TIME.

60 seconds . . . . .	1 minute	<i>sec. min.</i>
60 minutes . . . . .	1 hour	<i>ho.</i>
24 hours . . . . .	1 day	<i>da.</i>
7 days . . . . .	1 week	<i>wk.</i>
4 weeks . . . . .	1 month	<i>mo.</i>

*Quarterly terms for payment of wages, rent, &c.*

Lady Day, 25th March. | Michaelmas Day, 29th Sept.

Midsummer Day, 24th June. | Christmas Day, 25th Dec.

Longest day in the year, 21st June.

Shortest day, 21st December.

Every fourth year is called *leap year*, and consists of 366 days.\*

## ANGULAR MEASURE.

60 seconds . . . . .	1 minute	<i>sec.</i>
60 minutes . . . . .	1 degree	<i>min.</i>
30 degrees . . . . .	1 sign	<i>s.</i>
90 degrees . . . . .	1 quadrant	
12 signs, or 360 degrees . . . . .	1 circumference.	

\* To find when leap year happens, divide the given year by 4; if nothing remain, it is *leap year*.

### A TABLE OF ALIQUOT PARTS OF MONEY.

[illegible]

## TABLE OF ALIQUOT PARTS OF WEIGHTS AND MEASURES

<i>Of a Pound Troy.</i>	<i>Of a Ton.</i>	<i>Of half a cwt., or 56 lbs.</i>	<i>Of a qr. of a cwt. or 28 lbs.</i>
oz. $\frac{1}{2}$	10 cwt. $\frac{1}{2}$		
$\frac{1}{3}$	5	28 lbs. $\frac{1}{2}$	14 lbs. $\frac{1}{2}$
$\frac{1}{4}$	4	14 $\frac{1}{4}$	7 $\frac{1}{4}$
$\frac{1}{6}$	2	8 $\frac{1}{2}$	4 $\frac{1}{2}$
oz 10 dwt $\frac{1}{8}$	1	7 $\frac{1}{8}$	
$\frac{1}{12}$			

## FRENCH MEASURES AND WEIGHTS.

## MEASURES OF LENGTH.

The French Unit of *Length* is the *Mètre*.

inches.                      yards.

**The Metre = 39·370079 = 1·0936133**

	inches.			inches.
1	lomètre = 39370	} METRE, or 1.0936133 yds.	{	Décimèt. = 3.937
2	ctomèt. = 3937			Centimèt. = .3937
3	camètre = 393.7			Millimèt. = .03937

## MEASURES OF SURFACE.

The French Unit of *Surface* is the *Are*, which is the Square whose side is a Décamètre, or ten Mètres.

	sq. yards.	sq. chains.	acres.
The Are =	119·599	= ·247105	= ·0247105
Kiliare = 119599	} ARE,	or	Deciare = 11·9599
Hectare = 11959·9			Centiare = 1·19599
Decare = 1195·99			Décimètre quarré =
	119·599 sq.yds.		15½ sq. in.

## MEASURES OF VOLUME.

The French Unit of *Volume* is the *Sterè*, which is a Cube whose side is a Mètre.

	cubic inches.	cubic feet.	cubic yards.
The Sterè =	61023	= 35·31469	= 1·30795
Decastère = 13·0795	} STERE,	or	Decistère = 1·30795
			1·30795 cu. yds.

## MEASURES OF CAPACITY.

The French Unit of *Capacity* is the *Litre*.

	cubic inches.	gallons.	pints.
The Litre =	61·02379	= 220085	= 1·76068
	pints.		pints.
Hectolitre = 176·068	} LITRE,	or	Decilitre = 1·76068
Decalitre = 17·6068			Centilitre = 0·176068
	1·76068 pts.		

## MEASURES OF WEIGHT

The French Unit of *Weight* is the *Gramme*.

	grains.				
The Gramme =	15·4327	= {	·03215 ounces Troy.		
			·03527 ounces Avoirdupois.		
	grains.			grains.	
Myriagr. =	154327	} GRAMME,	or	Decigr. =	1·54327
Kilogr. =	15432·7			Centigr. =	·154327
Hectogr. =	1543·27			Milligr. =	·0154327
Decagr. =	154·327				
		15·4327 grs.			

## MISCELLANIES.

12	articles . . . . .	1 dozen.
20	ditto . . . . .	1 score.
144	ditto . . . . .	1 gross.
24	sheets of paper . . . . .	1 quire.
20	quires . . . . .	1 ream.
8	lb. of meat . . . . .	1 stone.
7½	lb. . . . .	1 gal. of train oil.
36	trusses . . . . .	1 load of hay or straw.
56	lb. . . . .	1 firkin of butter.
64	lb. . . . .	1 ditto of soap.
100	feet . . . . .	1 sq. of flooring.
272½	do. . . . .	1 rod of walling.
5	bushels . . . . .	1 sack of flour.
50	feet . . . . .	1 load of hewn timber.
40	do. . . . .	1 do. of unhewn do.
108	solid feet . . . . .	1 stack of wood.
128	do. . . . .	1 cwt. of ditto.
19½	cwt. . . . .	1 fother of lead.
14	lb. . . . .	1 stone of iron.
100	lb. . . . .	1 quintal.
14	lb. . . . .	1 peck of salt.
60	skins . . . . .	1 roll of parchment.
1760	yards . . . . .	1 mile.
16	bushels of bran, or pollard	1 quarter.
2	bushels . . . . .	1 hundred of potatoes.
4	ditto . . . . .	1 sack.
40	ditto . . . . .	1 load.

## MISCELLANEOUS QUESTIONS.

WRITE down in figures the sum of eleven thousand,  
eleven hundred and eleven. *Ans.* 12111.

If 2 cakes cost 2½d., what will 2 dozen cost?

*Ans.* 2s. 6d.

If 6 apples cost 2d., how many could I get for a  
crown? *Ans.* 180.

How many yards of cloth, at 17s. 6d. per yard, can I buy for 13 cwt. 2 qr. of wool, at 15d. per lb.?

*Ans.* 108.

If I pay 13s. 4d. a week, how many months' board can I have for £100?

*Ans.* 37 mo. 2 wk.

A gentleman spends, one day with another, £1 7s. 10½d., and at the year's end he lays by £340; I demand his yearly income.

*Ans.* £848 14s. 4½d.

How many pairs of shoes, at 5s. 9d. per pair, ought to be given for 3½ dozen pairs of silk stockings, at 17s. 3d. per pair?

*Ans.* 126.

What quantity of raisins can I purchase for £3 10s., if 7 lb. cost 2s. 11d.?

*Ans.* 1½ cwt.

Bought spices at 10 guineas per cwt., and sold them at 2s. 0¾d. per lb.; what was the gain per cent.?

*Ans.* £10.

If a clerk's salary be £73 a year, what has he a day?

*Ans.* 4s.

The less of two numbers is 187, and their difference 34; what is the square of the product?

*Ans.* 1707920929.

What is the interest of £152 for 2 years, at 2½ per cent. per annum?

*Ans.* £7 12s. 0d.

What is the amount of £1000 for 5½ years, at £4 15s. per cent.?

*Ans.* £1261 5s. 0d.

A tradesman failed for £10000, his effects produced £6798 10s.; what did a creditor receive, whose debt was £790 18s.?

*Ans.* £537 13s. 10½d.

A French franc is valued at 10d., how many in £100?

*Ans.* 2400.

A bankrupt's estate paid 7s. 9d. in the pound, and his debts amounted to £14980, how much do creditors receive and lose?

*Ans.* They received £5804 15s. 0d.,  
and lost £9175 5s. 0d.

Divide £1000 amongst three persons; give A £120 more, and B £95 less than C.

*Ans.* A gets £445; B £230; and C £325.

If I buy a yard of cambric for 12s. 6d., and sell it for 14s. 3d., what do I gain per cent.?

*Ans.* £14.

If 30 men, in 40 days, build 50 rods of wall,

How many men in 60 days will do the same—that's all?

*Ans.* 20.

Gave a hogshead of gin, at 7s. 4d. a gallon, for 56 gallons of rum; what is the rum worth a gallon?

*Ans.* 8s. 3d.

If I buy at £6 8s., and sell at 8 guineas, what do I gain per cent.?

*Ans.* £31 5s. 0d.

If 3 cows can be kept upon 20 acres, 3 roods, of grass land, how many acres will 25 cows require to be fed upon?

*Ans.* 172 acres, 3 roods,  $26\frac{2}{3}$  poles.

If 1 cwt. of cheese cost 2 guineas, how much can be bought with the sum of £23 10s. 10 $\frac{1}{2}$ d.?

*Ans.* 11 cwt. 23 $\frac{1}{8}$  lb.

If for 2s. 7 $\frac{1}{2}$ d., I can buy 7 lb. of plums, what quantity can I have for £1059 14s. 3d.?

*Ans.* 504 cwt. 2 qrs. 14 lb.

At what rate per cent. will £956 amount to £1314 10s. in 7 $\frac{1}{2}$  years' time, simple interest?

*Ans.* £5 per cent.

How many planks of 15 feet long, and 15 inches wide, will floor a warehouse 60 feet 6 inches long, and 33 feet 6 inches wide?

*Ans.* 108  $\frac{7}{8}$ .

Bought 274 yards of cloth for £217 9s. 9d., half of which cost me 14s. 6d. a yard; what did the remainder cost me a yard?

*Ans.* 17s. 3d.

Europe is supposed to contain 227700000 inhabitants; how much would a halfpenny per head, per month, amount to in 7 years?

*Ans.* £39847500.

A balloon moving at the rate of 6494 feet in a minute; how long would it be going round the earth, supposing its circumference to be 25000 miles?

*Ans.* 14 days, 2 hours, 46 minutes.

A pint will contain 9000 barleycorns; how far would they all reach, placed one after another?

*Ans.* 8 yds. 1 foot.

How many times will a wheel, that is  $2\frac{3}{4}$  yards round, turn between London and York, which is 198 miles?

*Ans.* 126720.

How many parcels of sugar, each 16 lb. 2 oz., are in 16 cwt. 1 qr. 15 lb.? *Ans.* 113, and 12 lb. 14 oz. over.

A gentleman left 50 guineas to be distributed in the following manner:—to poor men, each 5s.; to poor women, each 4s.; to poor boys, each 2s. 9d.; and to poor girls, each 2s. 3d.; and that there should be an equal number of each; what was that number?

*Ans.* 75.

In 3 casks of oil, weighing, No. 1, 4 cwt. 19 lbs.; No. 2, 3 cwt. 1 qr. 17 lbs.; No. 3, 5 cwt. 3 qr. 18 lbs.; how many gallons, allowing 16 lbs. per cwt. for tare, and  $7\frac{1}{2}$  lbs. net to a gallon?

*Ans.* 172 $\frac{3}{8}$ .

What must I pay for 179 cwt. 1 qr. 13 lbs. of sugar, at 48s. 6d. per cwt.?

*Ans.* £434 19s. 3 $\frac{3}{8}$ d.

How many ingots of gold, each 7 oz. 19 dwt. 13 gr., at 4s. 9 $\frac{1}{2}$ d. per ounce, may be bought for 500 guineas?

*Ans.* 274.

What is the discount of £125 for 21 days, at £5 per cent.?

*Ans.* 7s. 2 $\frac{1}{2}$ d.

What is the discount and present value of £487 10s. 8d., due in 6 months, allowing £6 per cent.?

*Ans.* £14 4s. discount; present value, £473 6s. 8d.

In what time will £540 amount to £734 8s., at £4 per cent. ?\*

*Ans.* 9 years.

\* As the interest of the principal for one year is to one year, so is the whole interest to the time required.

At what rate per cent. will £540 amount to £734 8s. in 9 years?\*

*Ans.* £4 per cent.

A mercer bought  $13\frac{1}{2}$  pieces of silk, each containing  $24\frac{3}{4}$  ells, at 6s.  $0\frac{3}{4}$ d. per ell; how much did the whole come to?

*Ans.* £26 3s.  $4\frac{3}{4}$ d.

How many halfpence are there in £100, and as many guineas?

*Ans.* 98400.

Three persons purchased a ship; A pays  $\frac{2}{3}$ , B  $\frac{1}{3}$ , and C £2700 for the remainder; what is the value of the vessel?

*Ans.* £12000.

Light travels at the rate of 192268 miles in a second; how long is it coming from the sun, supposing the distance of the sun from the earth to be 95 millions of miles?

*Ans.* 8 minutes, 14 seconds.

If a piece of wainscoting be 8 ft. 6 in. long, and 2 ft.  $9\frac{1}{4}$  in. broad; what is the superficial content, and value at  $10\frac{1}{2}$ d. a foot?

*Ans.* 23 ft. 10 in.  $10\frac{1}{2}$  pts.; value £1 0s. 11d.

In a cistern 8 ft. long, 5 ft. deep, and 20 in. broad how many gallons of water will it hold?

*Ans.*  $415\frac{1}{2}$  gal.

What is the compound interest of £860 for 2 years, at  $£4\frac{1}{4}$  per cent. per annum, the interest payable half yearly?

*Ans.* £84 13s.  $1\frac{1}{4}$ d.

Bought 27 bags of ginger, each weighing gross  $84\frac{3}{4}$  lbs., tare  $1\frac{3}{8}$  lb. per bag, tret 4 lbs. per 104 lbs.; what do they come to at  $8\frac{1}{2}$ d. per lb.?

*Ans.* £76 13s.  $2\frac{3}{4}$ d.

What is the value of  $\cdot 625$  of a pound,  $\cdot 34$  of a shilling, and  $\cdot 95$  of a penny?

*Ans.* 12s.  $10\frac{3}{4}$ d.

What is the square root of 179136?

*Ans.* 444.

What is the square root of  $\frac{169}{441}$ ?

*Ans.*  $\frac{13}{21}$ .

What is the cube root of 9938375?

*Ans.* 215.

What is the cube root of  $\frac{512}{3375}$ ?

*Ans.*  $\frac{8}{15}$ .

\* As the principal is to the interest for the whole time, so is £100 to the interest of the same time; then divide that interest by the time, and the quotient shows the rate per cent.



## PAPERS

FOR

## EXAMINATION IN ARITHMETIC.

No. I.

1. How many hours are there from 9 o'clock on Monday morning to 5 o'clock on the following Saturday evening? *Ans.* 128 hours.

2. From March 7th, 1852, to September 30th, 1853, how many days and hours, both days included? *Ans.* 573 days, 13752 hours.

3. Divide 67124176 by 112, both by long division, and also by the method of factors. *Ans.* 599323.

4. In 364428 inches, how many miles?

*Ans.* 5 miles, 6 fur., 3 yds.

5. Find the greatest common measure of 5070 and 5850, and the least common multiple of 12 and 15.

*Ans.* 390 and 60.

6. What is the sum of  $1\frac{1}{2}$ ,  $2\frac{2}{3}$ , and  $3\frac{3}{4}$ ? *Ans.* 8.

7. Divide  $\frac{2 + 3\frac{1}{2}}{4 - 3\frac{1}{2}}$  by  $\frac{4 + 3\frac{1}{2}}{6 - 3\frac{1}{2}}$ . *Ans.*  $3\frac{3}{4}$ .

8. Reduce  $\frac{2}{3}$  of £7 4s. to the fraction of £3 12s.

*Ans.*  $\frac{4}{5}$ .

9. Multiply 375.4 by .057, and divide 3.1 by .0025.

*Ans.* 21.3978 and 1240.

10. Reduce £2 15s. 2½d. to the decimal of a pound, and also to the decimal of £2 10s.

*Ans.* 2.759375 and 1.10375.

11. At Calcutta, the rupee is worth 1s. 11½d., what is the value of a *lac* (100000) of rupees?

*Ans.* £9895 16s. 8d.

12. If 3000 copies of a book of 11 sheets require 66 reams of paper; how much paper will be required for 5000 copies of a book of  $12\frac{1}{2}$  sheets?

*Ans.* 125 reams.

No. II.

1. How many times will the driving wheel of a locomotive turn in going from London to Cambridge, a distance of 52 miles, the circumference of the wheel being 16 feet 6 inches?

*Ans.* 16640.

2. If a man gains 18s. 6d. per week, and spends in the same period 14s.  $11\frac{3}{4}$ d., how much does he save in a year?

*Ans.* £9 3s. 1d.

3. If the pound weight of standard gold be coined into £46 14s. 6d.; what is the value of an ounce of standard gold?

*Ans.* £3 17s.  $10\frac{1}{2}$ d.

4. Find the greatest common measure of 1644 and 2316; and the least common multiple of 4, 9, 10, 21, 28, and 35.

*Ans.* 12 and 1260.

5. Find the value of  $3\frac{1}{2} + 4\frac{1}{2} - 5\frac{1}{2} + 16\frac{3}{4} - 8\frac{7}{8} + 6$ .

*Ans.*  $16\frac{3}{4}$ .

6. Find the value of  $\frac{1}{2}$  of  $\frac{3}{10}$  of a pound +  $\frac{8}{15}$  of 2s. 6d. -  $\frac{7}{8}$  of  $4\frac{1}{2}$ d.

*Ans.* 2s.  $3\frac{1}{2}$ d.

7. If 8 cwt. 3 qrs. are carried 110 miles for 30s.; how far should 3 cwt. 3 qrs. be carried for the same money?

*Ans.*  $256\frac{2}{3}$  miles.

8. Three men make a joint stock, of which A contributes £64; B, £88; and C, £96; if their profits amount to £108, find the share of each.

*Ans.* A's, £27 17s.  $5\frac{1}{2}$ d.  $\frac{4}{3}$ ; B's, £38 6s.  $5\frac{1}{2}$ d.  $\frac{3}{4}$ ; and C's, £41 16s.  $1\frac{1}{2}$ d.  $\frac{6}{7}$ .

9. Extract the square root of 7659; and also of .001.

*Ans.* 87.51571, and .0316227.

10. Find the interest and amount of £1200 12s. 6d. for  $1\frac{3}{4}$  years, at  $£3\frac{1}{2}$  per cent. simple interest.

*Ans.* £73 10s.  $9\frac{1}{2}$ d.  $\frac{3}{4}$ ; and £1274 3s.  $3\frac{1}{2}$ d.  $\frac{3}{4}$ .

11. The side of a square court-yard measures 42 feet; what will it cost paving at 2s. 6d. per square yard?

*Ans.* £24 10s.

12. In how many days of 15 hours each, would 60 men perform a piece of work, when 45 men can do the same in 30 days of 12 hours each?

*Ans.* 18 days.

No. III.

1. The *Times* Newspaper has a circulation of 12460 daily; what is the sum realized by its sale, at 5d. per copy, from January 1st to June 30th, 1852?

*Ans.* £47244 3s. 4d.

2. What sum must be divided among 36 men, so that each may receive £12 15s. 2½d.?

*Ans.* £459 7s. 6d.

3. Find the greatest common measure of 5070, 5850, and 1339.

*Ans.* 13.

4. What is my annual income when the excess of  $\frac{2}{3}$  of it, above the remainder, is £60?

*Ans.* £156.

5. What part of 7s. 6d. is  $\frac{1}{4}$  of  $\frac{3}{4}$  of  $\frac{2}{3}$  of  $1\frac{1}{2}$  of 7s. 6d.?

*Ans.*  $\frac{1}{4}$ .

6. Find the cube root of 24618329, and of .0001.

*Ans.* 290·906119, and .0215443.

7. A cistern has two pipes, by one of which it may be filled in 40 minutes, and by the other in 50 minutes; it has, likewise, a discharging pipe, by which it may be emptied in 25 minutes. In what time would the cistern be filled, if all the three pipes were open together?

*Ans.* 3 hours, 20 minutes.

8. How much copper and tin will be required to cast a cannon, weighing 17 cwt. 3 qrs. 10 lbs., gun-metal being composed of 100 parts of copper, and 11 of tin?

*Ans.* Copper, 16 cwt. 8 lbs.;  
tin, 1 cwt. 3 qrs. 2 lbs.

9. What is the present worth of £252 0s. 6d., due 4 months hence, at £3 per cent.?

*Ans.* £249 10s. 7d.  $\frac{1}{10}$ .

10. How many yards of paper,  $\frac{3}{4}$  yard wide, will paper a room 18 feet long, 15 feet broad, and 10 feet high; allowing 13 yards for door and windows?

*Ans.*  $84\frac{1}{2}$  yards.

11. Exchange £1500 into francs, at 25·18 per pound sterling.

*Ans.* 37770 francs.

12. If 8 men can cut 112 acres of grass in 16 days, working 12 hours a day, how many men could mow 63 acres in 12 days, working 8 hours a day?

*Ans.* 9 men.

#### No. IV.

1. A and B go to bed at the same hour daily, but A rises at  $\frac{1}{4}$  past 6, and B at  $\frac{1}{4}$  to 8; how much of waking life will A have had more than B in 36 years; Leap years being taken into account?

*Ans.* 1 year, 319 days, 20 hrs., 15 min.

2. Find the least common multiple of 34, 51, 17, and 2.

*Ans.* 204.

3. Reduce  $1\frac{1}{2}$ d. to the decimal of a pound, and 9s.  $11\frac{1}{4}$ d. to the decimal of £1 6s. 6d.

*Ans.* ·00625, and ·375.

4. An officer's pay is 12s. 3d. per day; what is that in a year?

*Ans.* £223 11s. 3d.

5. What is the value of ·04535 of a mile, and also of ·375 of a guinea?

*Ans.* 14 po. 2 yds. 2 ft. 5·376 in.; and 7s.  $10\frac{1}{2}$ d.

6. The rental of a parish amounts to £8000, and the expense of maintaining the poor amounts to £635; what rate per pound must be laid on the parish to defray this expense, and how much will a person have to pay whose rental is £134?

*Ans.* 1s. 7d.  $\frac{1}{10}$  per pound, and £10 12s.  $8\frac{1}{2}$ d. ;.

7. At what rate will the simple interest on £498 16s. 8d. amount to £74 16s. 6d. in 5 years?

*Ans.* £3 per cent.

8. What sum must be invested in the 3 per cents, at  $97\frac{1}{2}$ , to yield an annual income of £250?  $\frac{3}{2}$

*Ans.* £8093 15s.

9. Gunpowder is composed of 76 parts of nitre, 14 of charcoal, and 10 of sulphur; how much of each of these will be required for 3 cwt. of powder?

*Ans.* 2 cwt. 1 qr.  $3\frac{2}{3}$  lbs. of nitre; 1 qr.  $19\frac{1}{3}$  lbs. of charcoal; and 1 qr.  $5\frac{2}{3}$  lbs. of sulphur.

10. How many yards of carpet, 3 quarters wide, will cover the floor of a room 27 feet 6 inches by 17 feet 6 inches?

*Ans.* 71 yards,  $10\frac{1}{2}$  inches.

11. At  $1\frac{1}{2}$ d. per shilling profit, how much is that per cent.?

*Ans.* £12 $\frac{1}{2}$  per cent.

12. If 6 compositors set up a work of 6 sheets in 10 days, how many sheets will 4 compositors set up in 30 days?

*Ans.* 12 sheets.

#### No. V.

1. Two boats start in a race, and one of them falls 4 feet behind the other in every 50 yards, how much will it have lost at the end of half a mile?

*Ans.* 23 yards,  $1\frac{2}{3}$  feet.

2. What is the value of 113 stones of wool, at 18s.  $4\frac{1}{4}$ d. per stone?

*Ans.* £103 14s.  $0\frac{1}{4}$ d.

3. Divide £115 10s. among 5 men and 6 women, giving each man thrice the share of a woman.

*Ans.* A man, £16 10s.; a woman, £5 10s.

4. A coach goes from London to Liverpool at the rate of 9 miles an hour in 24 hours; in what time would the distance be performed on the railroad at the rate of 32 miles an hour?

*Ans.* 6 hrs. 45 min.

5. What is the tax on a house rented at £65 10s. 6d., at 3s. 6d. per pound?

*Ans.* £11 9s. 4d.  $\frac{1}{6}$ o.

6. If 45 tenpence loaves can be made from 6 bushels of wheat; how many eightpence loaves can be made from 9 quarters?

*Ans.* 675 loaves.

7. Find the value of

$$\frac{3\frac{3}{4} - 2\frac{1}{8}}{3\frac{3}{4} + \frac{7}{8}} \text{ of } \frac{3\frac{1}{2} + 5\frac{3}{4}}{4\frac{1}{4}} \text{ of } \frac{2\frac{3}{4} + 1\frac{1}{2}}{7\frac{1}{4} - 3\frac{3}{4}}. \quad \text{Ans. } \frac{989}{389}.$$

8. Find the value of .375 of a guinea + .1875 of a crown + .3 of 7s. 6d. - .875 of 2d. *Ans.* 10s. 11d.

9. If 2 tons 3 cwt. 3 qrs. of sugar cost £120, and the expense of carriage be 50s., what is the gain per cent. if it be sold at £3.094 per cwt.? *Ans.* £10½ per cent.

10. The hour and minute hands of a watch are together at 12 o'clock, when do they next coincide?

*Ans.* 5  $\frac{1}{11}$  min. past 1 o'clock.

11. How many imperial gallons, each 277.2 cubic inches, will fill a rectangular vessel, whose dimensions are 4 feet 8 inches; 3 feet 8 inches, and 3 feet?

*Ans.* 325 gallons, 3 quarts, 1 pint,  $\frac{1}{11}$  qt.

12. Borrowed £1000 on March 20, 1852, of which I paid £300 on September 17; £150 on December 21; £220 on February 23, 1853; the balance is to be paid on July 23; what will then be due, principal and interest, at £4 per cent.? *Ans.* £366 8s. 1½d.

#### No. VI.

1. In measuring a certain distance, it was found that a rod of 7 feet 6 inches in length, was contained in it exactly 176 times; but when measured with another rod, it was found to contain it only 132 times exactly; find the distance, and how many inches was the one rod shorter than the other?

*Ans.* Distance, 440 yards, and difference of rods, 30 inches.

2. If the pound weight of silver be coined into 66 shillings; what is the weight of half a crown?

*Ans.* 9  $\frac{1}{11}$  dwts.

3. Simplify the expressions  $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}$ , and  $(\frac{1}{2} + \frac{1}{3}) \times (\frac{1}{4} + \frac{1}{5}) \div (3 - \frac{1}{2})$ .

*Ans.*  $\frac{7}{12}$  and  $\frac{5}{12}$ .

4. Find the value of  $5 - 5\sqrt{.0816}$  and  $4\sqrt[3]{.00816} + \frac{2}{3}\sqrt[3]{1331}$ . *Ans.*  $4\cdot11118056$ , and  $5\cdot32790037$ .

5. Divide  $\cdot04888501956$  by  $\cdot01548$ . *Ans.*  $3\cdot157947$ .

6. After taking out of a purse  $\frac{1}{3}$  of its contents,  $\frac{1}{3}$  of the remainder was found to be 13s.  $5\frac{1}{2}$ d.; what sum did it contain at first? *Ans.* £1 13s.  $7\frac{1}{2}$ d.

7. The chain for measuring land is 66 feet long, and divided into 100 links; what is the length of a wall which measures 24 chains and 56 links?

*Ans.* 540 yards, 11·52 inches.

8. Find the interest of £374 5s. from April 1, to December 29, at £4 per cent.? *Ans.* £11 3s.  $1\frac{1}{2}$ d.

9. Find the compound interest of £370 for 6 years, at £4 per cent.? *Ans.* £98 3s.  $4\frac{1}{2}$ d.

10. A can do a piece of work in 10 days, and B in 15 days, in what time can A and B do it jointly?

*Ans.* 6 days.

11. How many cubic feet are in an oak tree, whose length is 22 feet, and mean girth, 6 feet 2 inches?

*Ans.*  $52\cdot288$  cubic feet.

12. If  $\frac{1}{3}$  of a calf is worth  $\frac{1}{2}$  of a sheep, and 7 sheep are worth  $\frac{1}{2}$  an ox, and 3 oxen are worth 2 horses, and 1 horse is worth £30; what are the prices of a calf, a sheep, and an ox?

*Ans.* A calf, £2 2s.  $10\frac{1}{2}$ d.  $\frac{1}{4}$ ; a sheep, £1 8s.  $6\frac{1}{2}$ d.  $\frac{3}{4}$ ; and an ox, £20.

#### No. VII.

1. Find the value of 39 cwt. 0 qrs. 10 lbs., at £1 17s. 10d. per cwt. *Ans.* £73 18s.  $10\frac{1}{2}$ d.  $\frac{1}{4}$ .

2. Which is the cheapest, a hat which costs 15s., and will last 9 months, or one which cost 12s., and will last 7 months; and how much will a man save in 20 years who wears the cheaper kind of hat?

*Ans.* The 15 shillings' hat; Saves 11s. 5d.  $\frac{1}{4}$ .

3. Of what distance is  $4\frac{1}{2}$  miles, seven-tenths?

*Ans.* 6 miles, 3 fur., 17 po., 2 ft.,  $4\frac{3}{4}$  in.

4. Find the value of  $\frac{.004 \times .0003}{.006}$ , and prove the rules by which the decimals are pointed off.

*Ans.* .0002.

5. If a wall be 72 feet 6 inches long, and 19 feet 3 inches high, and  $5\frac{1}{2}$  bricks thick; how many standard rods of brickwork are there in it?

*Ans.* 15 rods, 28 sq. yds.,  $5\frac{1}{4}$  sq. feet.

6. If 14 men can mow 168 acres in 12 days of  $8\frac{1}{2}$  hours each, how many can be mowed by 20 men in 11 days of  $7\frac{1}{2}$  hours each?

*Ans.* 208 acres.

7. If 236 yards of cambric are bought at 7s.  $10\frac{1}{2}$ d. per yard, and sold, one-fourth, at 10s. 3d., one-third, at 8s. 6d., and the remainder, at 7s. per yard; what will be the loss or profit per cent. on the whole outlay?

*Ans.* £5  $\frac{1}{2}$  per cent. profit.

8. Reduce to their most simple forms the fractions,

$$\frac{7\frac{1}{2} - 3\frac{1}{2}}{7\frac{1}{2}}; \quad \frac{2}{3 + \frac{1}{2} + \frac{1}{3}} \quad \text{and} \quad \frac{24.075}{7.5}.$$

*Ans.*  $\frac{4}{7}$ ,  $\frac{2}{11}$ , and 3.21.

9. Extract the square root of 1369.7401, and the cube root of .000000042875.

*Ans.* 37.01 and .0035.

10. Prove that the value of 144 things, in shillings, is obtained by multiplying the price in farthings by 3.

11. A post is one-fourth of its length in the mud, one-third in the water, and 10 feet above the water; find its whole length?

*Ans.* 24 feet.

12. Supposing bell-metal to be composed of 110 parts of brass and 2 parts of silver; and that brass is £9 3s. per cwt., and silver £3 per lb. Troy; what is the cost of a bell, weighing 13 cwt. 2 qrs. 14 lbs., allowing £20 for the charge of casting and the waste of metal?

*Ans.* £241 15s. 9 $\frac{3}{4}$ d.



## No. VIII.

1. If 9 things cost £12, what will 13 cost? Prove the method by which this sum may be worked, using no other than the first four rules of arithmetic.

*Ans.* £17 6s. 8d.

2. Reduce  $\frac{3}{4}$  to its lowest terms; multiply it by  $\frac{1}{2}$ , and divide the product by  $\frac{1}{4}$ .

*Ans.* 1.

3. If the rents of a parish amount to £2340 17s. 6d., and a rate of £137 10s. 8d. be granted, what sum will be payable upon an estate of which the rental is £143 9s. 10d.?

*Ans.* £8 8s. 7½d.  $\frac{24243}{48000}$ .

4. If 3 lbs. of tea be worth 8 lbs. of coffee, and 12 lbs. of coffee worth 31 lbs. of sugar, what quantity of sugar may be had for a chest of tea weighing 28 lbs.?

*Ans.* 222½ lbs.

5. Divide £300 among A, B, C, so that A shall have twice as much as B, and C twice as much as A and B together.

*Ans.* A, £66 13s. 4d.; B, £33 6s. 8d.; and C, £200.

6. A stationer sold quills at 11s. a thousand, by which he cleared  $\frac{3}{8}$  of the money; what would he gain per cent. by selling them at 13s. 6d. a thousand?

*Ans.* £96 7s. 3¼d.  $\frac{1}{4}$ .

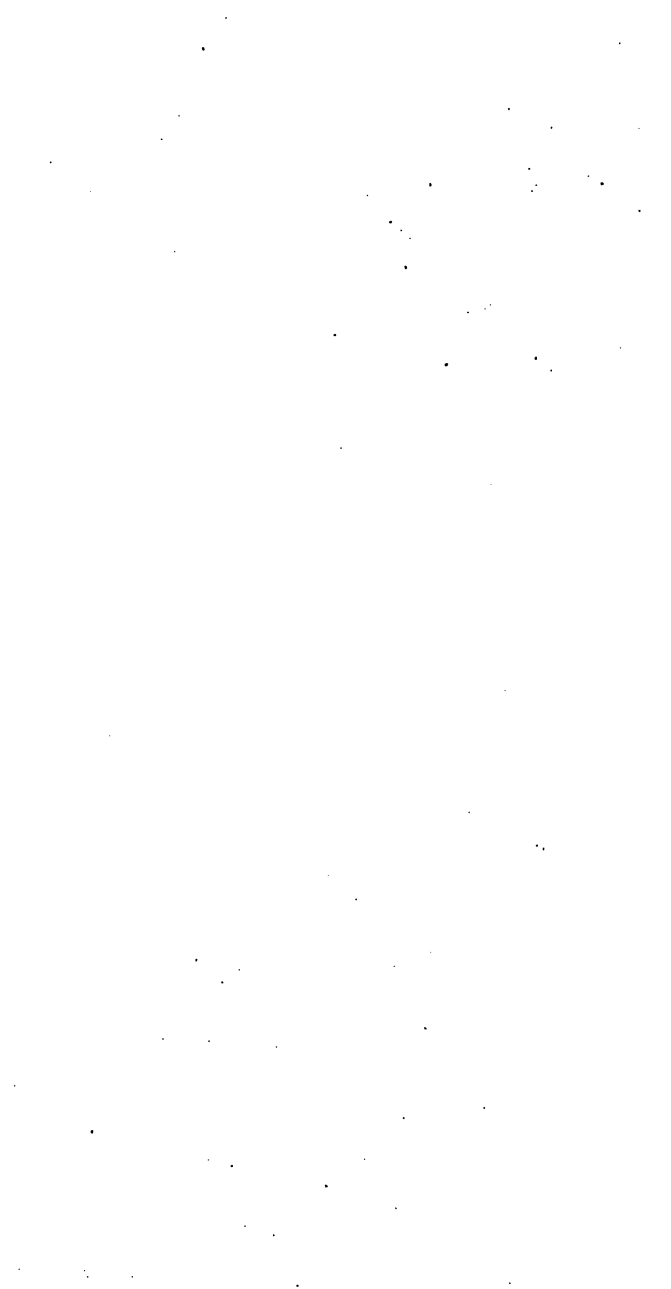
7. If A can reap two-thirds of a field in 4 days, and B two-fifths of it in 3 days; in what time can A and B jointly reap three-fourths of the field, and also the whole field?

*Ans.* 2½ days, and 3½ days.

8. A father left £12000 to be divided among his three sons, so that the youngest should have  $\frac{1}{3}$  of the share of the second, and the eldest  $\frac{2}{3}$  of the shares of the other two together; find the share of each son.

*Ans.* Youngest, £3500; 2nd, £4000; eldest, £4500.

THE END.



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